ENGINEERS AND ENGINEERING IN OTHER LANDS.

[Specially translated and prepared from our exchanges.]

The "din of arms" bids fair to stop a few of the contemplated Oriental engineering works. The fabulous success of the Suez Canal was attracting the attention of capitalists to various undertakings, but they are either being subjected to a closer scrutiny or are indefinitely postponed. In the meantime attention has been called to the fact that the great steamship of the future—for we are not yet satisfied with such "swift-footed" monsters as the Alaska—will be too huge to go through the Suez Canal, which in its present form requires almost a specially built steamer, and thus the voyage round the Cape of Good Hope may come into favor again, as the superior speed of such steamers would considerably reduce the advantage now possessed by the Suez route. However, this is a rather long viewed argument, although the Suez Canal will doubtless be deepened when peace reigns once more in Egypt. Neither does the projected canal from Bordeaux to the Mediterranean meet with much favor from sensible capitalists and thoughtful engineers. A steamer entering such a canal at Bordeaux would have to pass forty locks, and would only be at Narbonne, while the second, with a full head of steam on, would have passed Gibraltar. Considerations of the comparative safety and navigation of the two routes are not in favor of the project. Still it is a "job" of 1,500 million francs ($300,000,000) and French politicians, no more than our own, are not unamenable to the reasons which the disbursement of such a vast sum carries with it.

M. de Lesseps has, of course, his hands full on "the Grand Canal," but his last report about the Panama one shows that American contractors will in all probability dig it, if it is to be. Huerne, Slaven & Co., of San Francisco, are to excavate between Colon and Gatun, to the extent of six millions of cubic metres at the rate of 1 fr. 50c. per cubic metre. Say in round numbers a job of $2,000,0000, if, however, there are more than six million metres, then the price is only 1 fr. 25c. An American company also undertook to excavate ten kilometres of the canal on the Panama side. But de Lesseps recommends that the system of interesting the engineers and employés in the rapid completion of the work by giving them a pecuniary premium or share, as was done in the Suez Canal, be adopted.

M. Laterrade promised to send an account of his system of leveling with marking out to the *Annales des Ponts et Chaussées*. In the meantime he contributes the following summary to the *Revue Industrielle*.

The slide of the telescopic level with air bubble is nothing but a sliding frictional cylinder. However well made a glass may be, there is always a certain amount of "play" between the two cylinders. The consequence is that the weight of the eye-piece and of the outer part of the slide cause the latter to oscillate, and the optical axis is raised.

This defect, which is scarcely perceptible in new and well made instruments, is often very prominent in old and worn out ones. It is not always possible to correct this by placing one's self at an equal distance from the two leveling staffs if the glass is moved for more than one marking, as the oscillation is not uniformly regular on account of the friction. A single marking out is therefore advisable, and we have tried it on such an extended scale that we can guarantee more satisfactory results by this method than with the ordinary one. We have thus surveyed:

1. A circle of 7 kilometres in length, comprising 108 stations in which the rise was 120 metres above the starting point, and the close 0.10 metres.

2. A line of 27 kilometres in length in a plain, comprising 345 stations, and making part of a circuit of 100 kilometres.

3. A line of 82 kilometres, containing 868 stations, making part of a circuit of 175 kilometres; the rise was up to 193 metres from starting point, closing at 0. M. .021.

The average assumed error per station obtained by dividing by number of stations the total of the absolute values of the partial differences between the first, and the verifying leveling was only 0.0018 metres in the first instance and 0.0012 in the third. This last is the greatest degree of exactness we could obtain, and we believe it will be difficult to surpass it in practice.

All exact leveling should be staked out so that the staffs rest either on an iron cylindrical benchmark or on a strong wooden picket with round head. When leveling with one marking, it is necessary to stake out the place of the level, as this must be at an exact distance from both leveling staffs, and there must be no chain work or testing when verifying for the level. At the same time there is no reason to exaggerate the nicety of the distance from the level to the staffs—0.30 M. or 0.30 metres will be quite near enough.

The rapidity with which surveying can be done by this method will astonish those who have not been accustomed to it. The first operation is naturally the longest, on account of the double staking out which is requisite, however, it can be proceeded with at the rate of from 8 to 10 kilometers a day; in verifying, from 15 to 16 kilometres can be done, and even up to 21 kilometers. Of course a vehicle is necessary in this case, if only for carrying the pickets and for conveying the men when verifying. When surveying by the stadium no reader is required, for being always at an equal distance from both staffs, the figures, both in front and rear, must always be the same, which is in itself a sufficient verification. If surveying by the stadium is not adopted, a reader must be employed. However, he need not use a special book, as the operator writes down the figures of the reader, if exact, below his own.

A method for insulating the masonry of vaults and trenches has been recently employed with much success in Germany. It consists in several sheets of asphalt, separated from one another by layers of some long-fibered vegetable, as flax, jute or cotton. These give the sheets of asphalt great flexibility and tenacity, even under low temperature, as is the case so often in tunnels. The asphalt sheets should be about 13 millimetres thick, and they can be heated on the spot. It is not necessary that they form a body with the masonry, but only to make a watertight revetment. Liquid asphalt may be poured between the joints.

BIDS FOR FREMONT, O., WATER-WORKS.

On July 25 the Trustees received bids for

3,400	lineal feet of	16-inch	pipe,		
5,600	"	"	12	"	"
4,600	"	"	10	"	"
5,600	"	"	8	"	"
26,700	"	"	6	"	"
10,200	"	"	4	"	"

} 1,400 tons.

Also, 18 tons of special castings.

Also, for furnishing lead and gaskets and laying said pipe, including trenching and back-filling, setting hydrants and valves, including the furnishing and setting valve-boxes, vaults and covers.

Also, for furnishing ninety-five hydrants.

Also, for furnishing valves as follows: Three 16-in.; three, 12-in.; five, 10-in.; eight, 8-in.; forty-five, 6-in.; and twenty-seven 4-in. valves.

Also, for furnishing materials and erecting one metallic stand-pipe, 25 ft. diameter and 100 ft. high, including foundation for same.

Also, for pumping machinery, as follows: One compound or condensing engine of capacity to pump 2,000,000 gallons of water in 24 hours against 225 ft. head, and one non-condensing engine of 1,000,000 gallons capacity under like conditions, including engine foundations.

Also, two return tubular boilers approximately 5 ft. 4 in. diameter, 16 ft. long, including foundations, settings and connections.

Also, one brick building, to be subdivided into an engine-room about 40x40 and boiler-room of same dimensions, together with coal-room, tool-room and office-room, as per detailed drawings.

Also, one brick smoke-stack, 100 ft. high.

The following bids were received:

PIPES AND CASTINGS.

Dennis Long & Co., Cincinnati	$53,255.88
Cincinnati & Newport Iron & Pipe Co., Newport, Ky	51,102.00
R. D. Wood & Co., Philadelphia, Pa	55,160.00
Gloucester Iron Co., Gloucester City, N. J	60,895.00
A. H. McNeal, Burlington, N. J	52,572.00
L. S. Foundry, Cleveland, O	52,780.00

PIPE LAYING.

J. E. Driesbach, Elyria, O	$19,758.00
MacRitchie & Nichol, Chicago	17,902.00
MacRitchie & Nichol, Chicago, furnishing and laying, setting valves and hydrants	74,900.96
H. N. P. Dole & Co., Columbus, O	16,840.25
James Boylan, Fremont, O	22,664.00
J. L. Rawson, Fremont, O	32,750.00
R. B. Carothers, Newport, Ky	15,440.00
R. B. Carothers, Newport, Ky., furnishing and laying, setting valves and hydrants	63,789.00
Thomas B. Keating, Mansfield, O. (no bid on 10-in. pipe)	14,528.00
James J. Newman & Co., Brooklyn, N. Y	19,656.00
D. A. Chappel, Chicago	21,205.00
D. A. Chappel, Chicago, furnishing and laying, setting valves and hydrants	78,600.00
D. F. Manahan, Springfield, O	17,446.00

ENTIRE WORK.

D. F. Manahan, Springfield, O., pumping machinery, valves and hydrants, at trustees' option	144,848.00
Holly Manufacturing Co., Lockport, N. Y., works complete except stand pipe	134,400.00
R. D. Wood & Co., Philadelphia, Pa., works complete with Knowles' pumping machinery, excepting stand-pipes, brick masonry, cast-iron vaults, corners and frames and concrete	110,000.00
R. D. Wood & Co., Philadelphia, Pa., brickmasonry, $12 per M.; castings, 4c. per lb.; concrete, $6 per yard.	

VALVES AND HYDRANTS.

Hutchinson & Alexander, Allegheny, Pa	5,915.29
Chapman Valve Co., Indian Orchard, Mass	7,037.82
Boston Machine Co., Boston	6,704.50
Ludlow Valve Mfg. Co., Troy, N. Y	6,592.30
Mohawk & Hudson Mfg. Co., Waterford, N. Y	6,044.30
Julius Jonson & Co., New York	7,866.50
R. D. Wood & Co., Philadelphia, Pa	6,528.00
Jas. Flower & Bros., Detroit, Mich	6,865.77

PUMPING MACHINERY, BOILERS AND FIXTURES.

Thos. McGregor, Detroit, boilers and settings	4,730.00
D. June & Co., Fremont, O., boilers and settings	3,450.00
J. P. Merriam, Sandusky, O., boilers and setting	4,750.00
W. S. Jarboe, Pittsburgh, Pa., pumping machinery and boilers	14,500.00
W. S. Jarboe, Gaskill's engines and boilers complete	22,000.00
H. G. Moore, Sandusky, O., boilers and settings	3,371.00
Knowles Steam Pump Co., N. Y., pumping machinery and boilers	14,383.00
Knowles Steam Pump Co., N. Y., pumping machinery without boilers	10,350.00
Knowles Steam Pump Co., N. Y., boilers complete	4,033.00
Geo. F. Blake Mfg. Co., N. Y., pumping machinery and boilers	14,380.00
Geo. F. Blake Mfg. Co., N. Y., pumping machinery without boilers	10,080.00
Holly Mfg. Co., Lockport, N. Y., pumping machinery and boilers	25,700.00
Holly Mfg. Co., Lockport, N. Y., Gaskill's pumping engine, boilers and settings	23,000.00
Cope & Maxwell Mfg. Co.,, Hamilton, O., pumping machinery and boilers.	18,900.00

STAND-PIPE AND FOUNDATION.

H. G. Moore, Sandusky, O., complete	28,998.00
Jno. McGregor & Son, Detroit, excepting stairway and cornice	15,500.00
Buckeye Bridge and Boiler Works, Cleveland, O., above foundation	20,235.34
Stacy Manufacturing Co., Cincinnati, above foundation	19,869.31

Thomas McGregor, Detroit	15,400.00
J. P. Elderkin, Fremont, O., foundation complete	6,525.00
James Boylan, Fremont, O., foundation, puddling and paving	12,978.00
Dennis Hannan, Toledo, O., foundation.	8,665.00
J. K. Cramer & Co., Toledo	5,460.60

BUILDINGS AND SMOKE-STACK.

Theo. Brockman, Fremont	$12,418.00
J. P. Elderkin, Fremont	11,500.00
C. Whittingham & Co., Toledo	10,550.00
James Boylan, Fremont	12,000.00
J. K. Cramer & Co., Toledo	16,000.00
Wm. A. Huderson, Fremont	11,691.00

THE FIRST GAS WORKS.

In 1798 Murdoch built the first gas-works of any magnitude at Messrs. Boulton & Watt's factory, at Soho, near Birmingham, where a great sensation was made by a triumphant illumination on the occasion of the peace of 1802; and six years later Murdoch received the gold medal of the Royal society as the reward of his ingenuity and perseverance. Though the adaptability of gas for lighting purposes was thus proved, the cleansing process was as yet very defective. With a view to improvement in this and other respects, a series of experiments was made by a German named Winsor, at the commencement of the present century. In 1803 his first public experiment was made, the Lyceum theatre being then for the first time lighted with gas. A course of lectures delivered by Winsor, explaining his system, during the following year, led to the formation of the first gas company, with a capital of £50,000, the whole of which was expended in experiments without bringing any return to the shareholders. Three years later Winsor exhibited his new light in a row of lamps in front of the colonnade before Carlton house, then standing in Waterloo place. But his scheme was ridiculed by the scientific authorities of the day, and his application for a charter in 1809 for the National Light and Heat Company was refused at the instance of Murdoch, who, however, subsequently withdrew his opposition, and the company was incorporated. Still public prejudice remained unconquered. Sir Humphrey Davy himself gave it as his opinion that "it would be as easy to bring down a bit of the moon to light London as to succeed in doing so with gas," and in 1813 the inquest men of St. Dunstan's prosecuted William Sturt, of No. 188 Fleet street, for "the making of gas-light and making and causing to be made divers large fires of coal and other things; by reason whereof, and divers noisome and offensive stinks and smells and vapors, he causes houses and dwellings near by to be unhealthy." In spite of prejudice and opposition the work went on, and in 1814 William Knight started a company, and built gas-works at Whitefriars, and on Christmas day of that year the fate of the old oil lamps was sealed; the metropolis was for the first time generally lighted with gas.

By 1282 Winsor's company already owned 122 miles of pipe in the London streets, and was supplying 680,000 cubic feet of gas nightly, and twenty years later there were no fewer than eighteen public gas-works in London, employing a capital of £2,800,000 and manufacturing 1,460,000,000 cubic feet of gas per annum. The last public place in London to adopt the new-fangled illumination was Grosvenor square, which resisted the tide of progress until 1842. Then, at length, the street oil-lamp finally disappeared and the face of linkmen became extinct, nothing remaining to remind us of their existence except the great extinguishers which may still be seen at the doorways of many old houses. Gas had won the supremacy which it has now maintained for three-quarters of a century, and which it must soon again yield up to its more powerful rival.—*St. James' Gazette.*

THE ENTRANCE HALL AT ABBOTSFORD.

The entrance hall at Abbotsford, the home of Sir Walter Scott, is forty feet in length. Its lofty ceiling of oak, fashioned into a series of arches, is exquisitely carved; the walls, which are also of oak, from Dumfermline Abbey, are richly decorated in the same manner. The floor is made of black and white marble from the Hebrides. Along the walls are many suits of old armor, the most noticeable being an English suit of the time of Henry V., and an Italian one of more recent date; above them are the coats of arms of the ancient border clans, conspicious among these being the arms of Douglas and the Royal Lion of Scotland. There are also helmets, rapiers and claymores in great variety, as well as Polish lances, and a suit of chain mail taken from the corpse of one of the royal body-guard of Tippoo Sahib, ruler of Seringapatam, when that Hindoo city was besieged and captured by the English in 1799. On one side, in a niche formed by a window, is a glass case containing the last suit of clothes worn by Sir Walter. Hanging on the wall, at the extreme end near the left door, are the keys of the old Tolbooth prison. There are also relics in this entrance hall of James VI., and Claverhouse, the "Bonny Dundee" of Scottish prose and poetry. Only two windows light the hall, and they are so obscured by coats of arms that the interior has been spoken of as being "as dark as the twelfth century." I leave my young friends who study history to decide how dark that is. Standing in one of the corners, but not visible in the picture, is an American axe that was much prized by Sir Walter as the gift of Washington Irving. Many of you have doubtless read Irving's description of his stay at Abbotsford. It is a fine tribute to the host who entertained him so royally. The farewell at the gate was "I will not say good-bye, but come again." Irving tells us that he was so impressed while there with the fact that Sir Walter, notwithstanding the miracles of work he did, contrived to be ever at the command of his guests, continually devising plans for their enjoyment.—*From "A Visit to the Home of Sir Walter Scott," in* ST. NICHOLAS *for August.*

THE POTOMAC RIVER.

Mr. S. T. Abert, United States civil engineer, has submitted to General H. G. Wright, Chief of Engineers, his annual report upon the improvements of the Washington and Georgetown harbors. He gives a history of the work from the 11th of July, 1870, to June 9, 1881, when proposals were asked for dredging between the northeast end of the Long Bridge and Greenleaf's Point, United States Arsenal. The contract, which was awarded to the National Dredging Company, of this city, at the rate of 24 cents per cubic yard, provided for dredging the Washington channel to a depth of 15 feet at low water, and to a width of 200 feet, or as much as the funds would permit, the material to be deposited on the harbor flats, next the causeway of the Long Bridge. The work was commenced December 5, 1881, and continued night and day, with the exception of necessary delays, and when operations ceased, June 1, 1882, 240,111 cubic yards of material had been dredged. The excavation was made with a clam-shell dredge, and dumped upon the flats by means of a tramway. Mr. Albert's estimate of the cost is 16.85 cents per cubic yard. In regard to the

GEORGETOWN HARBOR AND CHANNEL

the report states that by the utilization of $15,000, which had not been specifically appropriated for this work, together with $30,000, which belongs to it, some work could be done, and work was commenced on the bar below Easby's Point, June 13, 1882, by the Potomac Dredging Company, to whom the contract had been given for twenty-eight cents per cubic yard, and is still in progress. The report states that the safety of navigation in Georgetown harbor would be much increased by the excavation of rocky points, some of which are found near the wharves and at dangerous depths at other points in the channel. Near the inclined plane there are 1,600 cubic yards to be removed, to a depth of nine feet at low water; three hundred and ninety feet below the Aqueduct, 104 cubic yards; southwest of mill sluice 480, Kennebec Ice Company, 211, 74, 128, 171, and 113 cubic yards to be removed. G street wharf, 34.5, 87, and 889 cubic yards. Northwest of Analostan boat-house, 6,000 cubic yards; work not needed now. No award for rock excavation was made because proposals could not be had for less than $28 per cubic foot, which is regarded as excessive.

For the fiscal year ending June 30, 1884, an appropriation of $800,000 is recommended. During the past year $1,443.38 was expended on the improvement of

THE POTOMAC AT MOUNT VERNON,

for which there is no appropriation this year; $5,000 is recommended for next year. In reference to other points on the Potomac Mr. Abert states that the amount available for the fiscal year for improvement at Breton Bay (Leonardtown) is $5,003.95; estimated amount required for the completion of existing project, $10,000; amount can be profitably expended in year ending June 30, 1884, $10,000. For the improvement of Nomini Creek the sum of $2,000 is appropriated for the present year, and $10,000 is asked for the ensuing year. For the improvement of harbor entrance to St. Jerome Creek, Maryland, $5,000 is appropriated for this year, and $10,000 asked for next year. For the improvement of Nenbsco Creek no appropriation was made for the present year. Last year $4,701.70 was expended, and a balance of $286.67 remains. The sum of $51,000 is estimated to complete the improvement, and $20,000 is asked for next year.

THE South Pennsylvania Railroad Company have about two hundred men engaged in the surveys of their line. Location is nearly completed, revisions being the chief order of the day. The office of the company is at 32 Broadway, New York. Oliver W. Barnes is Chief Engineer.

MEXICAN NATIONAL RAILROAD.

Some remarks made last week in this column in regard to the sale of $5,000,000 bonds of the Mexican National Railroad to an English syndicate, have elicited several letters from persons interested in the scheme, including one from an official of the company. He says that President Palmer has never announced that he had succeeded in placing $10,000,000 bonds. This may be so, for General Palmer was abroad at the time. But the statement *was* publicly made, and no contradiction of it was given by any of his associates here, who are very sharp fellows. The said official also thinks that General Palmer, "as a gentleman," could not mention how many or how few cents on the dollar the London syndicate has agreed to pay. But General Palmer, "as a business man," might possibly have vouchsafed some sort of information on this subject, particularly as the completion of the road within the specified time must depend upon his success in raising money.

The securities of the English railroad from Vera Cruz to the city of Mexico are on the London Stock Exchange, and so are the Mexican Government bonds. But they have been there for many years, and this has nothing to do with the likelihood of Gen. Palmer's procuring a quotation for his Mexican enterprise. In the spring of 1880, when the representatives of this concern were "lobbying" in the city of Mexico for concessions, an agent of English capitalists was also there, ready to undertake the construction of railroads in Mexico if some arrangement was made in regard to the Government bonds, and it was only the influence which Gen. Grant brought to bear during his visit to Mexico that decided the question in favor of the American party. Had the bond business been arranged with England, diplomatic relations between England and Mexico would have been resumed.

It has also been attempted to controvert the statement made in this column that it is only lately that the railroad from Vera Cruz to the city of Mexico has become a paying concern. That the statement is correct will be seen at a glance from the following figures: The ordinary share capital or common stock of that company is $11,260,150. There are, in addition to that, $12,770,500 of first preference shares, $5,059,800 of second preference shares, and $10,000,000 in 6 per cent. debenture stock. In order to pay the charges on the three last the sum of $1,905,228 is needed, and in no year until 1880 was this amount earned over the running expenses. In 1880 and 1881 the construction of the American railroads began, and the English railroad made large profits by charging $30 a ton for transporting railroad material from Vera Cruz to the city of Mexico. Any one can see that this kind of business can only be temporary. Besides, it would be absurd to compare the magnificent Vera Cruz & Mexico road, passing through the very garden of the land, with the hastily built "Mexican National," running through the maguey plantations and cactus groves of the northern wilderness. Mexico may get civilized some day, and its railroads may become paying concerns; but no substantial improvement in that line is likely to take place during the present generation.—*N. Y. Sun.*

ADVICE TO A YOUNG MAN.

BOB BURDETTE.

Keep up with the procession, my boy. Don't hang back in the breeching. You may be able to make things drag a little, but you can't stop the team, and you'll have to come along. There was a man, an eminent mathematician Dr. Lardner, of England, who published a treatise to prove that no steamship could ever cross the Atlantic Ocean, and the steamer Sirius, a few weeks later, brought the first copies of his pamphlet to America. This same eminent scientist also "staked his reputation as a man of science," before the House of Commons, on his statement that no railroad train could ever go faster than ten miles an hour, and the slightest curve would invariably throw it off the track. Babinet, the French calculator, declared that no telegram could ever be transmitted from Europe through the Atlantic to America. There was a man right here in America, only one hundred years ago, who opposed the rebellion of the colonies because he knew it would be a failure. There was a man who laughed himself sore at Fulton's absurd ideas about steamboats. There were members of Congress who wanted Morse shut up in an insane asylum because he talked about a telegraph, which was an impossibility. There was a man who said you could never build a bridge across the Mississippi. There was a man who said you could never raise wheat on the great American desert. There was a man who swore he would call the roll of his slaves in the shadow of Bunker Hill monument. There was a man who "knew" that nothing but a steam-horse could ever trot inside of 2:40. There was a man who "knew" you couldn't make the sun

draw your portrait. There was a man who "knew" you could never find a better light than a whale-oil lamp. There was another man who knew you could never beat lard-oil. There was another man who said Colonel Drake was a gibbering idiot because he said he could pump a better oil than lard-oil out of the ground like water. There was another man who said Edison was insane when he talked about an electric light. There was another man who said the phonograph was a clever trick of ventriloquism. There was a man who said the telephone was a newspaper lie. There was a man in England who led mobs of agricultural laborers to destroy threshing machines. There was a man in America who "knew" the invention of the sewing-machine meant starvation for the poor seamstress. And there is a man to-day who says all people may come to America, save only the Chinese. There is a man who "knows" the Indians can never be civilized. There is a man who "knows" we have reached the limit of human progress. There is a man who "knows" the gigantic corporations will devour the country. There is a man who "knows" the people are helplessly enslaved, and will never rise to assist themselves. There is a man who "knows" that all politics are corrupt, all politicians mercenary, the civil service rotten to the core, and our social life is honey-combed with decay. Now, my dear boy, there's only one way for you to escape that man's whining and obstinate, mulish opposition to everything. Keep so far ahead of him you can't hear him. And do you keep moving and drag him along. Rasp him with the double-trees; he has to come, for the old chariot never stands still a second. The difference between you and that man, my boy, is that you run and he is dragged. You spring along, with your eyes open, your head erect, and you help to keep things moving. He has his feet set in the road, his eyes shut tight, his back up on his shoulders and his heart under the wheels. Every time you make a leap you throw the dust back in his face. Don't, my boy, whatever you do, don't get back beside that man. Don't have any breeching on your harness. Put on a breast collor, and that is enough; you'll run more lightly and feel freer. Let the man in the breeching hang back. All that you have to do is to step out, keep pace with the times, sing as you march and keep the man in the breeching so covered with dust the world will only know he's there by the dirt around him. It may be, Telemachus, you will run a little fast sometimes; it may be that you will kick over the traces in your exuberance of spirit; you may sometimes want to strike a 2:19 gait on a 8:20 road; you may need more curb than whip, but go it, my boy. There is a good driver on the seat, and a firm hand on the lines, and I'd rather see you coming down the long vistas of history with the bit in your teeth, your heels in the air, the brake-rod sprung and the dash-board flying, than down on your haunches, your eyes shut and your back bowed, the lash on your flanks and your collar up to your ears, your legs set like crowbars and the dust of the whole team flying in your face, while you hang back in the breeching and only come along because you can't help it.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page 279.*)

CCCLXXII.—PORTSMOUTH, O.

Portsmouth, Ohio, in lat. 38° 53', long. 83° W., is on the Ohio River at the mouth of the Sciota, on a nearly level plateau, extending back about a mile from the river to a range of low hills.

Settled in 1798, it was incorporated as a town in 1815. Water-works were built by the city in 1871, under the superintendence of W. C. Weir, taking the supply from the Ohio River, through 210 ft. of brick and wood conduit, and pumping directly into the mains by a steam engine, driving six piston pumps of 14-in. diameter and 14-in. stroke, built by the Holly Manufacturing Company. The ordinary pressure is 45 lbs., and the fire pressure 110 lbs.

Distribution is by 18 miles of cast-iron pipe, of from 16-in. to 4-in. diameter, with 90 fire hydrants, 102 gates, and 1,220 taps. Wrought-iron service pipes are used.

The population in 1880 was 11,314, and the daily consumption in 1881 was 1,900,000 gallons.

The works have cost $200,000. There is a bonded debt of $150,000 at 8 per cent. interest. The gross receipts have been $151,525.28. The expenses for the year ending May 1, 1882, were for maintenance, $11,596; for extensions, $3,220.41. The receipts were $13,881.40. Interest on bonds is paid by the city. The works are controlled by three Trustees, one being elected each year. Charles Zeigler is the Superintendent.

CCCLXXIII. TRENTON.

Trenton, New Jersey, in lat. 40° 13', long. 74° 46' w., on the Delaware River, is on undulating ground, rising in some places to 100 ft. above the river. The Assanpink Creek flows through the city. It was settled about 1760.

In December, 1801, the Legislature passed an act reciting that: "Whereas Stephen Scales hath represented that he hath purchased a spring in the city of Trenton, from which he can conduct the water through several of the streets of the said city, thereby supplying the inhabitants with plenty of sweet and wholesome water, provided he can be authorized to lay his trunks through some of the intervening lots," the privilege of so doing was granted to him. Under this act a stock company was formed with a capital of $1,200 and to which a charter was granted in December, 1803. The water from this spring supplied the citizens until 1852 when the company was authorized to take water from the Delaware River, and to build reservoirs. A 10-in. pump driven by water-power from the Delaware was erected, lifting the water into a reservoir holding 1,415,000 gallons, 100 ft. above the river. The company expended $88,000 on the works, and in 1855 the city purchased the majority of the stock, issuing bonds for the same. Fire hydrants were put in first at this time.

In 1856, an additional reservoir was built, after plans of Charles Potts, C. E., and in 1863 a steam pumping engine was built by William Carr, of 12-in. pump bore.

In 1876, a compound beam engine, operating a 16-in. pump, was erected by William Wright.

The combined pumping power at the works will deliver 4,000,000 gallons daily, and the reservoirs contain 15,000,000 gallons.

Distribution is by 32 miles of cast-iron pipe, of from 16 to 2-in. diameter, with 185 fire hydrants and 5,338 taps and 38 meters.

The population in 1880 was 29,910. The daily consumption in 1881 was 1,275,126 gallons.

The cost of the works to Feb. 1, 1882, has been $327,000.

The bonded debt is $265,000 at 6 per cent. interest.

The expenses in 1881 were, for maintenance, $9,774.48; for interest, $15,850, and for extensions, $4,893.77.

The receipts were $47,874.59.

The works are managed by a board of six commissioners. John J. Sager is the Secretary and Treasurer, and John B. Quigley the Superintendent.

[TO BE CONTINUED.]

CORRESPONDENCE.

GARDAM'S PATENT V LEVEL.

NEW YORK, Aug. 15, 1882.

EDITOR ENGINEERING NEWS:

DEAR SIR: We notice, in your valuable issue of Aug. 12, 1882, a statement from F. E. Brandis, of this city, to the effect that we are infringing upon his patent. In reply, we simply say that a patent has been granted to us by the United States government, No. 260,473, date of issue July 4, 1882, and therefore we do not think that we are infringing upon his rights in any way. Also, we hold ourselves responsible at all times for any damages that F. E. Brandis may obtain against us; and we will fully protect any one of our customers or purchasers from any damages that may be obtained against them.

By publishing this you will greatly oblige us. We are yours respectfully,

W. GARDAM & SONS.

PROBLEM.

COLD SPRINGS, N. Y., Aug. 15, 1882.

EDITOR ENGINEERING NEWS:

Can you furnish a reader through the columns of your valuable paper a solution to the following problem:

Required the side of an equilateral triangle within which a point is situated, distant from the vertices of its different angles respectively 20, 28 and 31 ft. Respectfully,

HENRY THOMPSON.

A PROBLEM IN ALGEBRA.

BOSTON, Aug. 9, 1882.

EDITOR ENGINEERING NEWS:

As a constant reader of your valuable columns, may I inquire if the equations

$$\left.\begin{aligned} x^2 + y &= 11 \\ y^2 - x &= 1 \end{aligned}\right\}$$

can be solved? A number of interested readers await your answer. Respectfully, etc.,

AN ENGINEER.

[Only the answers will be published; to give the method (except possibly one case) is quite unnecessary.—ED. ENG. NEWS.

THE NEW CHARLESTOWN (MASS.) BRIDGE.

The Special Commissioners on the New Bridge between Boston and Charlestown have recommended an elevated structure described as follows:

The structure of the new avenue and bridge, which begins to rise at Traverse, on the westerly side of Charlestown street, is solid filling, supported by retaining walls, for a distance of about 470 ft., with a rising grade of 3½ ft. in a 100. Thence to the northerly side of Water street, in Charlestown, it will be carried on iron trusses of different lengths, resting upon granite piers. The span over Causeway street is 150 ft. long. Then come four spans of 75 ft. each, placed on a rising grade of two and twenty-eight-one-hundreths ft. in 100. After these, at a level grade, are six spans, one of which is the draw, each of 160 ft. in length.

These are followed by six spans, of 75 ft. each on a falling grade of two and three-fourths ft. in 100, one of which is over the tracks of the Fitchburgh Railroad, and another over Water street. Thence to City square, with a falling grade of 4 ft. in 100, and a distance of about 295 ft.; the structure is solid filling, again supported by retaining walls. The trusses of all the spans, except at the draw and where the railroad and streets pass under the bridge, are below the roadway. Three trusses are used for each fixed span. The draw is a pivot draw of the full width of the bridge, revolving end for end and moved by steam power.

The estimated cost of this new avenue and bridge is placed at $1,222,000, of which $782,000 is for the construction of the avenue and bridge, completed for travel, and $440,000 for land damages.

A MAN ON THE COW CATCHER.

"The time is not far off when every locomotive drawing a passenger train on every busy railroad will have a pilot. This pilot will have no more to do with the engine itself than the pilot of a ferry-boat. His duty will be to simply look ahead and communicate with the engineer in the cab." The man who uttered this prophecy was not a sentimentalist, but a very busy, practical railroad man, in charge of twice as many, if not three times as many trains as any other man on the Atlantic coast.

"The pace has been rapidly getting hotter and hotter in railroading," he continued, "until every improvement the human mind can suggest is adopted as fast as it is thought of, and the big roads are like so many sets of the most perfectly adjusted clockwork. Every device for switching, signalling, ballasting, taking water or coal, and, above all, making speed, is the subject of constant study and improvement, two things being kept in view always and in all things—saving time and preventing accident. Between New York and the big cities within a few hours' ride of it the tracks are dotted with trains running like mad. If there is the least flaw in anything—engine, cars, tracks, switches, signals, time-tables, or what not—there is likely to be a smash up. So much time and money are spent in guarding against the possibility of accident that serious ones are very rare. But in the midst of all this race for perfection the engineer is as he was at first. He is unimproved. He is only a man, and the best man can only do so much. An engineer was all that was wanted a few years ago, but now it is different. The engineer of to-day has got more than he can do. Somebody must ease him of some of his load."

"So," continued the railroad man, "I predict that every passenger locomotive will soon carry a pilot. I don't know where he will be—whether on the cab or in front of the cab over the boiler, or in front of the boiler over what we now call the pilot and you call the cow-catcher, but he will be carried on every locomotive that carries trains at a high rate of speed, and he will watch the signals, switches, bridges, highways and junctions, and do nothing else, while the engineer runs his engine.

"As it is, the engineer may be trying his water-gauge just when he should be looking at a signal. There are half a hundred necessary things he may be doing that will take his eyes off the road for an instant. He will miss a signal; and a wreck will be the result. Mind, I don't say what has happened. I am not going to tell any tales out of school. I only say it will happen."

"Don't the firemen on fast trains get into the way of helping their engineers more and more as time goes on?"

"No. They, too, have all they can do. The faster the train the more they have to work. Nothing can be looked for from them. The only thing is, as I tell you, a third man in a little house of his own ahead of or over the engineer, with a bell rope communicating with a gong in the cab. You'll see him there in a very few years."

THE Tehuantepec Railroad Company having forfeited its charter, the Mexican government will complete the road, the work being done under the direction of General Diaz.

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.
S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, AUGUST 19, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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VAN NOSTRAND has issued, as Nos. 59 and 60 of his Science Series, S. W. Robinson's papers on Railroad Economics and Strength of Wrought Iron Bridges.

IN the last number of the Pi Eta Scientific Society of Rensselaer Polytechnic Society, of Troy, N. Y., Geo. H. Ennis writes on manufacture of paper, Wm. J. Bates, C. E., describes Chicago from an Engineering Point of View, and P. H. Baermann, C. E., describes in an illustrated paper the Manufacture and Use of Cast-Iron Pipes. This really valuable publication is for sale by the Secretary at Troy, N. Y.

TWELVE copies of "Greene's Bridge Trusses" remain unsold. The price is 60 cents per copy, which may be remitted in postage stamps and unregistered. These few copies will close out the original edition of this popular and valuable bridge treatise. The price of the enlarged edition is $2.50, and practically the cheap edition which we are selling is as valuable as the more costly one. Only twelve more orders can be filled; after that the money will be returned.

RECENT SCIENTIFIC DISCOVERIES.

The Annual Report of the Regents of the Smithsonian Institute for the year 1880, has just been distributed. It is full of very valuable and interesting scientific memoranda and papers, collated from scientific journals or contributed by individuals. The Bibliography of Sir William Herschel's scientific writings occupies 114 pages, as condensed by Prof. E. S. Holden and Dr. Chas. S. Hastings; "An Account of Investigations Relative to Illuminating Materials," by Joseph Henry, is reprinted from the Report of the U. S. Light-house Board for 1875, so great is the scientific value attached to the memoir, by Prof. S. F. Baird, Secretary of the Institution; Barometric Observations of Prof. E. S. Snell, of Amherst College, are discussed by Prof. F. H. Loud, of Colorado College, and an illustrated description of Luray Cavern, in Page Co., Virginia, is given at some length.

From the many pages of scientific memoranda we cull a few notes which we think will be of interest to our readers. From observations of Mars, made at Ascension Island in 1877, Mr. Gill finds the solar parallax to be 8".78. At the same opposition Mr. Maxwell Hall, in Jamaica, with an equatorial of 4 inches aperture, made the parallax 8".79. Master A. A. Nichelson, U. S. N., at his own expense, conducted a series of experiments on the velocity of light, resulting in determining the velocity to be 186,380 miles per second. Prof. Pickering in 1880 undertook to determine the light of all the stars visible to the naked eye at Cambridge, Mass. The stars are observed in the meridian. The photometer consists of a horizontal telescope, pointing to the west, and having two objectives. By means of two prisms mounted in front of the telescope, the pole-star is reflected into one object-glass, and the star to be measured into the other. The cones of light are made to coincide by a double-image prism, the extra images being cut off by an eye-stop. The star to be measured is thus seen in the same field with the pole-star, under exactly the same conditions. To determine the relative transparency of the air at different altitudes, a list of a hundred circum-polar stars has been prepared, to be observed at both upper and lower culminations. Progressive changes in the light of the pole-star may thus also be detected and eliminated.

Great activity has been manifested in physics during the years 1879–80. New and important discoveries have been made, improved modes of research have been devised, greater accuracy has been attained in measures of precision, and more uniform and precise standards have been adopted as units. Sainte-Claire Deville and Mascart communicated to the International Geodetic Association an elaborate paper, describing the construction and giving the properties of the new platinum-iridium standard of length. The alloy was made by Johnson, Matthey & Co., by fusing together 450 ounces of platinum and 55 ounces iridium. After suitable working it was drawn through a draw-plate into a bar accurately rectangular in cross section. Its density was now 21.51, and it was found to contain platinum 89.41, iridium 10.19, rhodium 0.17, rutheninm 0.10, iron 0.06. This alloy is harder and more resistant than platinum, is much more rigid, and has a high elasticity, its modulus being 21,912,000,000, and its elongation-coefficient, 0.0003. Its coefficient of expansion was in course of determination by Mascart, the elaborate preliminary measurements only being described.

C. S. Pierce has reported progress in the comparison of a wave-length with a meter. Using a Rutherford ruled plate of 340½ lines to a millimeter, three complete measures of Van der Willigen's spectrum line No. 16 gave for the angle of double deviation as a mean, 89° 54′ 19″.5. An error of 0.4″ would make an error of a micron in the length of the meter. Subsequently, another line near the former one was selected, and a finer plate was used. As a mean of six closely accordant measures, the double deviation was 90° 08′ 51″.45. One of these plates had been compared with all the centimeters of a decimeters cale. The other is to be compared with the even two centimeters of the same scale. This decimeter scale was in progress of comparison by Mr. Chapman with the decimeters of a meter scale. When done, a meter will have been compared with a wave length.

Herschel has published a paper on the use of the seconds pendulum for determining the figure of the earth, in which he comes to the conclusion that the experiments made hitherto are of little use, since the problem to be solved was so imperfectly grasped. The use of the absolute pendulum contemplated two distinct objects, which had no essential connection, the force of gravity and the figure of the earth; while the use of the differential pendulum contemplated only one.

The rate of the second's pendulum varies along the actual equator, and the value of gravity at the equator is therefore only an idea.

C. S. Peirce has given the results of his pendulum experiments, made under the direction of the Coast Survey.

The values obtained were:

At Hoboken, 0.9932052 m. At Paris, 0.9939387. At Berlin, 0.9942390. At Kew, 0.9941776. Reduced to the Sea level, these numbers become:

0.9932074, 0.9939500, 0.9942483, and 0.9941790.

Reduced to the equator, they are:

0.9910003, 0.9910132, 0.9909865, and 0.9910088.

These values, the author thinks, will have to be diminished by about twenty microns, on account of the error of the standard of length employed.

Mendenhall has made a series of experiments to determine the force of gravity at Tokio, Japan.

In the earlier part of the investigation, a Kater pendulum was used; in the latter, one of Borda's construction. The beats were recorded upon a chronograph at the same time with those of a break-circuit clock, the length of one second upon a sheet being about 8 mm., so that it could easily be subdivided.

Since it was only the fractional part of a second by which the two pendulums differed that was to be determined, the standard pendulum was only required to break the circuit twice, once at the beginning and again at the end of the experiment.

As a mean of six experiments with the Kater pendulum the value of "g" was found to be 9.7974; the mean of eleven experiments with the Borda pendulum gave 9.7984.

Edison's carbon filaments are constructed by cutting with a suitable punch from a piece of Bristol-board a strip in the form of a miniature horseshoe about 2 in. in length, and one-sixteenth of an inch in width.

These are laid in a wrought-iron mould, separated from each other by tissue paper, and heated first by a gas flame and then in a furnace to a white heat. After cooling, the charred fibre is sealed in a globe, which is then exhausted to one-millionth of an atmosphere. Subsequently, in experimenting with various fibres, Edison came to the conclusion that a natural fibre was more durable than an artificial one, and that Japanese bamboo furnished the best. The lamps which are made on the large scale are constructed with these fibres.

THE IRON TRADE.

The American iron trade has passed successfully through a summer which was threatened with more than ordinary dangers. The strike, which set ten thousand puddling furnaces idle on June 1, still continues, and despite reports to the contrary, is likely to continue for weeks to come. The Amalgamated Association is strong, and when it proclaimed war ten weeks ago knew a three to five months' contest was probable. The Association violated its pledged word in striking and has forfeited the respect which it claims. No terms of peace are probable. The manufacturers chafe under the arbitrary dictation of unionism which at the least occasion stalks into the office or counting-room with demands which, unless granted, will shut down the dampers in an hour.

While the men are surprised at the determination of their employers, they are by no means disheartened, and expect to be aided by an active fall demand which will drive the idle mills into an unwilling resumption. The price of iron and steel has been stationary since June 1. This is unusual. It shows that but for the strike prices would have declined, possibly to limits which would close a number of mills. The danger now is that if mills do start, the resulting abundance of iron will, in a short time, a few months at most, overstock the market and reduce prices to a minimum. This is all right for consumers who have been paying for a long time prices fixed by unfavorable market conditions.

The general outlook is favorable to an active fall trade in all Eastern and Western markets. Demand is steady and prices firm. The strike will continue until the strikers get tired.

Bar iron is selling at 2¼ to 2 4/10 in Eastern markets, and 2¾ to 3 in Western centres. Nails are kept down by sellers to $3.40 at mill. Stocks are very light and speculative inquiry is abroad, seeking to get control of stocks, and advance the market. Manufacturers have fallen into the same trap before, and are very careful to supply only actual customers.

Pig iron is firm in eastern markets, because of the blowing out of quite a number of furnaces. No. 1 Foundry sells at $26, No. 2, $24, Gray Forge, $22–$23, Bessemer, $25, Muck bar, $42–$43, Steel Rails, $47–$50, Iron Rails, $45–$48, Old Rails, $26–

$27. All individual establishments East are actively engaged on orders in hand, or in making up stocks which will be called on in a short time. Railroad building has not been renewed on a large scale, because of the existence of several causes of uncertainty, but the opportunity is waited for to invest millions. The mileage so far is not far from 5,700 miles for the year, and at the present rate of progress 10,000 miles will be exceeded before the close of the year. No large contracts have been made recently. When the heavy crops are moved it is expected that several half-completed roads will be hurried to completion. The delay has been due partly to the uncertainty as to the magnitude of the crops. Another element of uncertainty has been the labor troubles. The establishment of peace between the trunk lines, the increase of rates and the improving volume of traffic are all favorable indications for those interested in the iron and steel industry. No upward tendency in prices can long exist, as the productive capacity has reached limits which will provide for all probable consumptive requirements.

PERSONAL.

WILLIAM F. ELLIS, of Boston, chief engineer of the Connotton Valley (N. G.) railroad, has resigned.

H. G. WHITE, C. E., Towne Scientific School, '82, was appointed assistant to F. H. Lewis, Inspecter of Track, Buildings and Bridges, N. P. R. R., with headquarters at St. Paul, Minn.

FIRST-LIEUTENANT THOMAS L. CASEY, JR., Engineer Corps, has been detailed by the Secretary of War to accompany Professor NEWCOMB'S party to the Cape of Good Hope to make observations of the transit of Venus.

JESSE HOYT, one of the most widely known grain and flour merchants of this city, died on the 14th at his home, 51 West Forty-eighth street, in the 68th year of his age. Mr. HOYT is also well known as a builder of grain elevators. Two years ago he built the mammoth elevator at the Erie Railroad terminus in Jersey City. With ANGUS SMITH he built the first grain elevator put up in Milwaukee. This one, with two others that he built there, was afterward sold to what is now the Chicago, Milwaukee & St. Paul Railroad. He built three more elevators at Milwaukee, which he sold to the Chicago & Northwestern Railroad. More recently he had built a number of elevators in Chicago in the interests of both of the railroads mentioned. He was also largely interested in railways, principally in Illinois and Michigan. His fortune is estimated at several millions.

A leading journal of Madrid states that the father of ARABI PASHA was a maker of wooden cases in which dried raisins were kept at Barcelona. ARABI was brought up to his father's trade, according to this account, but, manifesting a love of reading, was sent to the University of Valencia, where for four years he studied law. But he abandoned his legal studies and became a chorus singer. After this escapade he was next heard of in Morocco, in a regiment of lancers, in which he had enlisted in 1859, and received for his bravery three decorations and a commission as Lieutenant. Falling in love, after the evacuation of Tetuan, with the daughter of a rich Jewish merchant, he deserted from the Spanish army and took refuge on an English merchant vessel, which was shipwrecked in the Straits of Bab-el-Mandeb. ARABI escaped, and after some wandering in Abyssinia and Nubia, settled in Egypt, became a Mohammedan, and studied the Moslem law.

GEN. JAMES H. LEDLIE died on the 15th, at St. Mark's Hotel, New Brighton, Staten Island, of dropsy and jaundice, after a brief illness. He was about 50 years old and a native of Utica. He graduated from the Scientific Department of Union College, and soon after was made a Division Engineer on the Erie Canal. At a later period he took the contract of the Seneca River Improvement Company for draining the marshes near Geneva, in this State. At the beginning of the civil war he joined the Army of the Potomac as Major of the Nineteenth New York Volunteers. Subsequently he was made a Colonel, and at the battle of Fredericksburg he commanded a brigade. After the battle he was promoted to Brigadier-General of Volunteers. During the greater part of 1863 he was Chief of Ordnance at Norfolk, Va., and he commanded the military in this city at the outbreak of the riots in 1863, but was superseded by General Butler. After the war he returned to the practice of his profession, and was the first person to demonstrate the practicability of taking rafts from the lumber regions across Lake Michigan to Chicago. Later he obtained and carried out the contract for the construction of bridges, trestles, and snow-sheds along the entire line of the Union Pacific Railway. After completing that work he built the breakwater in Chicago Harbor, and did some railroad engineering work in Georgia. He next visited Europe, and after his return, in 1879, he built the Nevada Central Railroad from Austin to Battle Mountain. He was when he died President of the Baltimore, Cincinnati & Western Railroad Construction Company, and First Vice-President of the railroad company; also Chief Engineer and General Manager of the Santa Rosa & Sonoma Central Railroad of California, Chief Engineer of the Nevada Southern Railroad, and largely interested in the Indian River Railroad of Florida.

THE RIVER AND HARBOR BILL.

Senator George F. Hoar, of Massachusetts, has addressed to that State a letter containing about 7,500 words, for the purpose of explaining his vote in favor of the River and Harbor bill, and his second vote for the same bill when it was passed over the President's veto. He says: "No representative of Massachusetts could have had the slightest personal motive to do other than his simple duty in the matter. The bill contained only the moderate appropriation of $371,000 to be expended within her limits, and this for objects so clearly just and reasonable that they would have kept their place if the bill had been reduced by two-thirds. If we have erred, it has been with the sincerest desire to do right and without the smallest motive to do wrong. I expect to satisfy you that we were governed by grave, honest, sound, Republican, Massachusetts reasons. In one thing, at least, you will agree with me. Being convinced by these reasons myself, if I had failed to act upon that conviction from any fear of personal consequences, I should have been unworthy of you and unworthy the respect of honest men. There is no son of Massachusetts who loves her more than I do. But fully believing, after careful consideration, that my duty to her and to the whole country required of me that vote, I could not have failed to cast it for all the honors and offices within her gift.

"What is this River and Harbor bill which has been the subject of such criticism? It appropriates $18,738,875. But of this sum, $5,368,500 are for the special improvement of the Mississippi River, according to the design of an eminent commission specially appointed in a former year to frame a plan for that purpose; $400,000 for the reclamation of the malarial and pestiferous flats near the White House, and $247,500 are for future surveys. To neither of these items, so far as I can learn, is there objection anywhere.

* * * * *

"Deducting these three extraordinary items, each of which might properly have been in a separate bill, there remain $12,722,875 as the subject of discussion. The expenditure of last year was $11,451,300.

"Further, of this whole sum of $12,700,000 there is but $1,353,475 that is new. All the rest is for public improvements partially completed, most of which have been going on for years, many of them under contracts, and all, or nearly all, if abandoned, will cause the loss of all the money previously expended.

* * * * *

"Let us turn our attention to the $5,400,000 to be expended on the interior waterways of the country other than the Mississippi and the Missouri. It is against this that the artillery of denunciation has been chiefly directed.

* * * * *

"Taking the movements of merchandise by waterways and landways other than by rail into account, the domestic produce moved and exchanged in this country must be, at least, between $30,000,000,000 and $40,000,000,000 in value, or more than forty times the value of our exports. The river commerce of the single city of Cincinnati was last year more than $45,000,000. There passes each year up and down Detroit River a tonnage greater than enters Liverpool. The number of vessels that go in and out of Chicago annually exceeds by 7,000 those of New York; and although these vessels are, of course, smaller in size, the actual tonnage of Chicago is much more than half that of New York. These waterways are not only of vast importance in themselves, but they are important also as a check upon the prices charged by the railroads. They are free. When the waterway is once fitted for transport it is the property of all mankind.

* * * * * *

"Railroad competition terminates in railroad combination. The only check on the power of the great railroad lines, when in concert, over the commerce of the Nation is the competition of the waterway. When the Erie Canal and the harbors of the lakes freeze in the winter, up go the freights. When canal, lake, and river open in the spring, down go the freights. I do not and cannot overstate the importance of this consideration to the American people, and more especially to Massachusetts. The diminution of the price of freight on the railroads of this country, 1 mill a ton a mile, makes an annual saving to the people of $70,000,000. Great as is the interest of the South and West in domestic commerce and transportation, it is not so great as that of Massachusetts. She manufactures nearly one thousand millions in value every year. Of this I am justified, by the opinion of a business man of large experience, in saying not one-fiftieth is sent beyond sea. The rest goes all over the land by river and rail and lake, to be distributed in the West and South, whence come her food and her iron and coal and wool and hides and cotton. Every obstruction removed from the channel in a Western river, every sunken rock blown out from a lake harbor, every creek or inlet by which a navigable stream reaches its arms into the midst of wheat fields or cotton plantations, is an obstacle the less in the way of the food to the mouths of her workmen, in the way of the material which their cunning fingers are to change into products of use and beauty, in the way of the sale of her manufactures to the customers on whom her wealth is to depend.

* * * * * * *

"This item of five millions of dollars is the expenditure of this year for that policy of internal improvement for which our earlier statesmen labored. It has been a Massachusetts doctrine since the days of Webster, and a Republican doctrine since the first great speech of Sumner.

* * * * * * *

"*The people get more for their money from this class of appropriations than from any other. These works are permanent. They do not perish with the using. The money is expended by the Board of Engineers. This board is made up of experienced Army officers, and has the confidence of the country more than any other public body, not excepting the Supreme Court itself. No member of Congress or anybody else can influence a dollar of the expenditure. The economy and honesty of the expenditure of no dollar in this department has ever, so far as I know, been challenged.*

* * * * * *

"The Constitution authorizes these expenditures only when the advantage received by the public repays the cost, and when that advantage is advantage to commerce with foreign nations or among the States. If the expenditure be wasteful, or if it be merely for individual or local benefit, it is to be condemned. But it does not follow from this statement that because a harbor or a waterway is within the limits of one State, or county, or town, it is for that reason local only. If the effect of the public work be to annex that community to the great system of national or international ways, and that community be of sufficient importance, or will be by the improvement made of sufficient importance, to make that annexation a national benefit, then the expenditure is warranted.

* * * * * * *

"But, it is said, when the President vetoed the bill, expressing his opinion that it contained unconstitutional provisions, and provisions entirely for the benefit of particular localities, you ought to have surrendered yours. I do not so read that constitutional mandate which I am sworn to obey.

* * * * * *

"But the duty of the Senator or Representative, when the President returns a bill with his objections, to vote on its reconsideration according to his own conscience is as clearly set forth in the Constitution as the duty of the President to act according to his.

"The President did not point out any item which he thought of local interest only, and did not point out any instance in which he thought the bill unconstitutional. He did not refer us to the information on which he acted, that we might see whether it were he or we that were deceived. We were, therefore, left to our own resources. If the bill failed, all public works of this class must stop. The suggestion that a general appropriation should be made of half the sum provided in the bill, with authority to the President to expend it

on such public works as he thought fit, seems to me, with due respect, totally inadmissible.

* * * * * *

"The public is perfectly protected. The money is to be expended by an executive department, subordinate to the President. If there be an unconstitutional provision in it, it is not only in his power, but it will be his duty, not to carry that provision into effect. This bill is not like the ordinary appropriation bills, under which the money is to be spent within the year. There is no limit or enactment as to the time within which the work shall be done. If the President shall be satisfied, on full inquiry, in regard to any single item, that it is unconstitutional, or not of public national importance, he can direct the Secretary of War to postpone the work until he can communicate the facts to Congress for further consideration.

* * * * * * *

"I have, since my return to Massachusetts, gone over the new items of this bill except five small ones, the reports in regard to which are not at hand. I believe every one of them to be warranted and constitutional within Mr. Webster's definition. I believe there is not an intelligent business man in Massachusetts who, if he will sit down with me at a table and make the examination, will not come to the same conclusion if he believe Mr. Webster's doctrine.

* * * * * * *

"If there be a single item in this bill placed there for an object not public and national, but private and local only, let it and those who voted for it be condemned. If in one single line it were framed so that votes for one provision might be purchased by votes for another, or the public money expended for private objects that legislators might gain personal or political advantage, let it be abhorred as tainted all through. But I confidently challenge the fullest criticism and discussion of this issue. The new provisions of the bill are fifty-seven in number. I gave above a list of fifteen of them, amounting to $847,000. The remaining forty-two are most of them for smaller amounts. I have carefully gone over them with the Engineer's reports, item by item, except in five cases, where special reports were sent the extra session of the Senate, and are not here. I declare my confident belief that there is not one of them that would not receive your vote, or that would not receive the votes of the most honest and zealous of those who have hastily and ignorantly denounced this measure, if he were to vote on it by itself.

"It is said that the bill is made up and carried by a vast system of log-rolling, by which the votes of members are obtained for the bill by inserting in it provisions for the worthless and useless jobs in their own districts. To what member from Massachusetts is this charge directed? I have never had the least reason to believe that the provision for any public work in Massachusetts depended on the opinions or purposes of any of her representatives in regard to the entire measure.

"The accusation is infinitely degrading and insulting, not only to Congress, but to the American people itself. That people must be rereduced to a low grade, both in intelligence and morals, whose representatives seek to win their favor by spending the public money for private or local jobs.

The very nature of the bill makes this thing an impossibility. The engineers reported that some $37,000,000 could be profitably expended this year. This does not include the sum recommended by the Mississippi Commission. In reducing this to $18,000,000 the committee were compelled to postpone many works of merit. The introduction of any worthless job must at once excite the antagonism of every man who had in his care the interest of a really worthy work which was excluded. The American people are not blind to their business interests.

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"There is one respect in which this river and harbor money is the best spent of all public appropriations, save only the pensions. There are vast spaces in this country where the United States government has been known for a generation only in the character of a conqueror or a tax-gatherer. It is good that they should see this great and beneficent power in its character of benefactor. Almost all the forces there are centrifugal. The United States is represented by a dozen Congressmen and Senators, by a District Judge and Marshal, and by the local postmaster, and that is all. The State has its governor, its judges, its executive departments, its numerous legislature, its state, county and town officers, wielding every important instrumentality of government. All these are interested in supporting the dignity and enhancing the authority of the state. This is well. It is the peculiar glory and security of American institutions. But it is also well that the people in those sections of the country who have been educated for half a century to look on the national government with jealousy and dislike, and who have felt its terrible power in war; in wasted fields and desolated homes, should learn to associate its image with the beneficent works which join them with the great system of national commerce, and on which their prosperity and wealth are hereafter to depend."

HOW RAILROAD MEN TIME TRAINS.

A DEVICE FOR SUPPLYING A TIME TABLE READY MADE FOR EXTRA AND IRREGULAR TRAINS.

Every railroad issues two time tables whenever the running time of trains is changed—one table for the public and one for the guidance of engineers and trainmen. The main difference between the two is that the schedule for the employés contains the time of every train at every station on its route, whereas the schedule for the public only gives the time at places where the trains stop. Dots and daggers and letters alongside of the time figures explain to the engineer and conductor at what points and why he is to stop. The absence of these show that the train is not to stop at all. There is naturally nothing about the conduct of a railroad on which more time and care are spent than these time tables, and the growth of railroading between the period not many years ago, when the Philadelphia Express was held at Newark or elsewhere for some regular passenger who had been belated, and the present time, when trains that run distances of 500 miles can be relied on to be at any point on their route on schedule time, is shown most clearly in the equal growth of the time table. The half minute appears for the first time in the schedule about to be issued for the New York Division of the Pennsylvania Railroad. Minutes had been fine enough divisions of time before. It is explained that the half minute has forced itself into recognition. Modern railroading is so fast, stations have grown so close together, and the movement of trains has become so regular, that this fine division of time not only can be but has to be made. Nothing greater than half a minute will apply to a train running at the rate of 60 miles an hour between New Brunswick and East Brunswick stations, which are just half a mile apart.

The time table in question has many other new features. It is to govern the movements of 226 passenger trains every day. It is no longer an unhandy chart, three feet long by two feet wide, like its predecessors, but a thin, narrow book, such as some other railroads long ago saw the wisdom of issuing. Its novel features are that its type is kept standing, and when any train's time is changed, instead of the change being published, as has always been done, on a separate sheet, apt to be mislaid or lost, the page in which it occurs will be corrected and reprinted, to be pasted into all the books by a man whose special duty that will be, and who will stamp the back of each corrected book before returning it. The Sunday trains are on yellow leaves, to distinguish them from the others, which are on white paper. Bound with the time-table, is a collection of diagrams, showing the position of the tracks and signals at the principal junctions and points where the switches are complicated. It is said that engineers learn by heart the switches on certain tracks upon which they are accustomed to run, and master thoroughly the switches governing those; but they are thoroughly at sea when, by reason of a blockade caused by a wreck or other irregularity, they receive telegraphic orders to take some track they are not used to. The diagrams give them the fullest information by means of a picture which admits of no misunderstanding.

The copyrighted speed schedules, which are also bound in the same covers, form a wholly new departure in railroad methods. They were designed to govern the movements of extra and irregular trains sent out at a moment's notice, and to be run at almost any given rate of speed. This portion of one of them shows what all are like:

Distance.	Stations.	Distance.	Average rate of speed per hour, 60 miles. West bound.	East bound.
....	Jersey City	89.66	....	1 30
2.47	Marion	87.19	3	1.27
3.67	Meadows	85.99	4½	1.25½
7.03	East Newark	82.63	7½	1.22½
....	Centre street, Newark	82.13	....	....
7.93	Market street, Newark	81.73	8½	1.21½
8.46	Chestnut street, Newark	81.20	....	....
9.25	Emmett street, Newark	80.41	10	1.20
10.58	Waverly	79.08	11	1.18½
12.27	North Elizabeth	77.39	12½	1.17
13.25	Elizabeth	76.41	14	1.16

The first column shows the distances from Jersey City and the third column the distances backward from Philadelphia. If, as is often the case, a special train to Philadelphia is ordered from Jersey City to make sixty miles an hour, the engineer, by means of the above schedule, knows that he must get to Marion in 3 minutes, to East Newark in 7½ minutes, to Waverly in 11 minutes, to Elizabeth in 14 minutes, and so on. These schedules are not drawn to a table of miles, but are practical, and are adjusted in accordance with the changing peculiarities of the road. In the above example, for instance, allowance is made for two draw-bridges between Jersey City and Newark, and the lost time is only partly recovered on the straight, unbroken track between Newark and Elizabeth. This is the case wherever curves, junctions, highways, grades and bridges are apt to cause delay. At such points a margin is left in the schedule, whereas there is none in such parts of the road as that between New Brunswick and Trenton, where there are long stretches of straight track, "and," as Trainmaster Charles Watts, the inventor of the new schedule, expressed it, "trains might as well be run eighty miles an hour as sixty." There is a schedule for each direction, because where there is an up-grade and a loss of time going one way, there is a down-grade and a gain returning.

Heretofore when a special train was to start, a calculation of about what speed it was to run at was made, according as the condition of the road at the time warranted. If it was at night, when the road is lined with freight trains, a high rate of speed was not considered as safe as in the daytime, but whenever it was, the engineer received his orders to run at the rate determined upon. If he happened to be a very intelligent and self-possessed man, used to irregular performances, he would keep up an even rate of speed, but the chances are great he would run like lightning half the time, then loaf the rest of the way. In all cases, the fact that he was coming would have been telegraphed ahead all over the line, and every freight engineer would be uneasy and anxious to seek a siding until the extra rumbled by and the danger was past. The signalmen and the operators in the dispatcher's office were also on tenterhooks trying to determine his whereabouts and the time of his arrival at points ahead. Now, with the new schedule, all are to be informed that an extra leaving at such a time will run at such a rate, and every man interested can satisfy himself by a reference to the tables just where the extra is or will be at any given moment. In cases where a train from the West is behindhand two, three or four hours, as is sometimes the case when a wreck blocks the road, it is to be annulled by telegraph. The schedule is to be of use again in governing trains run as second sections of regular trains. Now they are indicated by a flag carried ahead of the engine of the regular, but that entails their being run on the same time, which may be faster than is necessary. Hereafter they will be run on one of the new schedules, and announced ahead over the wires. Railroad men who have considered this invention say that it is a wonder that a railroad could ever have been run without it. A railroad man who was trying to think up all the possible uses of the new schedule, said that there is a millionaire cattle dealer in Princeton who frequently orders a special train, as well as a young New Yorker who engages one whenever he is on a lark.

"He always has a friend with him," said he, and he seems to think that the thing to do is to have a train all to himself. The other day he came—it was the third or fourth time—and said he wanted to go to Philadelphia as quick as possible. He was told it would cost him $150. We said he could have a car all to himself to any point in any regular train for eighteen regular fares, but he wanted a train and didn't mind the expense. He started at sixty miles an hour. When he got to Trenton he called in the conductor, and told him he had been trying to think why he had wanted to go to Philadelphia, and could not make out why it was. He said he thought he'd go back to New York. In that case the new schedule would have been a blessing.—*N. Y. Sun.*

THE WAR IN EGYPT, AND ENGINEERS.

There are strong indications that the forthcoming operations will constitute an engineering campaign, partly owing to the periodical overflow of the Nile, whose waters will be out about the period when active operations can be begun. The Franco-Prussian war of 1870-'71 was largely an "Intelligence Department" campaign. The Russo-Turkish war may be said to have been a "pick and spade" and "tactical" campaign, there having been but little strategy, and still less of railway operation. The Prussian Intelligence Department had been preparing for the war of 1870-'71 for eight years. This astute and highly organized department, during all this time, had its employés all over France under various pretexts and in various disguises. These able officers mapped out every line of railway throughout the country, including every branch line, and they prepared reports and notes of the amount of rolling stock of every description. They knew the strategic and tactical value of every railway station in the empire, large or small; they were perfectly familiar with the characteristics and value of every line that went near important positions or strategic points of value. Every highway and

bye-road, even every lane, was accurately mapped out; all towns, villages and hamlets, with their relative values as strategic or tactical positions, were recorded. The maps and information thus patiently gathered were carefully compared with the French staff-maps and other official documents, and corrected where necessary. They were then engraved on a small scale, and printed in many thousands ready for distribution to every commanding or staff officer as soon as war was imminent between the two countries. Even the resources of France for food supply were fully tabulated, so that requisitions on the inhabitants might be enforced. The railway time-tables for the dispatch of Prussian troops to the French frontier were compiled at the Intelligence Department, all having been carefully prepared and placed ready for immediate use. When the war broke out, the Prussian troops were rapidly taken to and massed opposite the French positions at Forbach and Wœrth. The Prussians vigorously attacked, and in a few days the world saw the most astounding feat of arms which it has ever witnessed, and a powerful nation was struck down at the feet of its conqueror. This campaign was indeed a grand lesson in the art of war, and its influence has been great upon the military systems of every European power, including that of Great Britain, for it caused this country largely to reorganize her whole military administration. Now is the first occasion that this new organization has been put to a practical test on an extensive scale.

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Engineering operations will play a highly important part in the coming campaign in Egypt, and events will doubtless illustrate strikingly the strategic value of railways in warlike movements. An elaborate and well-designed rolling stock and appliances for repairs has been prepared and shipped ready for transport, including several powerful locomotives, complete in every detail for immediate use. Major Wallace, R. E., an officer of great experience in the construction and management of railways, commands this portion of the expedition. This officer has had entire charge for some years of an extensive railway district in India, and he is well versed in every detail requisite for railway operations during war. Captain Scott, R. E., is second in charge. He is an officer of experience in traffic management and in practical details of railway construction and working. Captain Sidney Smith commands the Royal Engineer Railway Company, as it will be called. The remaining officers are young men who have just joined the corps from the Royal Military Academy at Woolwich. Their names are Lieutenant Vidal, Lieutenant Huleat, and Lieutenant Dopping Hepensthal; a fine opportunity for distinguishing themselves is now before them. The whole staff, officers and men alike, have been for some time past attached to trains running on the London, Chatham & Dover and the Southwestern Railways, where they have learned very valuable experience in railway work.

The Canada steamship, lying at the T pier at Woolwich Arsenal, is completely loaded with the equipment of the Royal Engineer Railway staff, who go out in this vessel; a wise arrangement, since the staff itself will superintend the unloading of the cargo, and will be under a final course of instruction on the way out. Timber, steel rails, switches, points, pot sleepers, and every requisite for the repair of lines broken up, and material for the repair of bridges, are on board the Canada, as well as an ample supply of tools of every nature. Steel-faced bullet-proof mantlets for working parties in trucks, or on the permanent way, have been supplied. Indeed, nothing seems to have been forgotten, and the state of this portion of the expedition gives a good augury for successful service—service that will doubtless enhance the already high reputation of the corps. A pontooning company has been formed at Aldershot, with a full supply of pontoons for crossing rivers and other water-courses. A telegraph company has also been organized, replete with every appliance of telegraphy in all its branches. The officers belonging to this company are constructive and working telegraphists, and the men have all passed examinations in every department of this science. Major Armstrong, R. E., a well-known officer, has rendered his valuable assistance towards the formation and equipment of this company.

The Royal Engineers, as the scientific corps of the British Army, will doubtless achieve the full measure of success they deserve, and it is not too much to say that the success of the campaign will depend chiefly on their efforts.—*Engineering.*

HAWAIIAN ISLANDS.—Hawaiian advices are to July 31: The Gibson ministry have carried all their measures. A $2,000,000 loan at six per cent., without government taxes; $1,500,000 for internal improvements, and $500,000 for immigration.

THE largest diamond-cutting house is in Amsterdam, employing 400 persons, where the Koh-i-noor was cut. The trade is difficult, and the wages are from $7 to $12 or even $14 per day.

THE ISTHMUS CANAL.

WHAT HAS BEEN DONE AND WHAT IS BEING DONE BY THE ENGINEERS.

Operations in connection with the projected Panama Canal have for some time past been principally directed to the completion of the surveys along the line of the canal. This work, though prosecuted with all possible dispatch, has met with considerable vexatious delay in endeavoring to materially reduce the excavations after the central line of the canal shall be determined. With this end in view, the regular engineer corps has been divided into exploring parties, each having its designated locality for a field of operations. The instructions invariably received are to ascertain the topography of the country along the main line of the canal as at present decided upon, note carefully the different acclivities encountered in the immediate vicinity, and their adaptability for stations. On the conclusion of these researches a report is submitted to the Executive Board at Panama, and by the comparison which is instituted a line is reached as a basis for future operations. Under the direction of Pedro Sosa, a prominent Colombian engineer, excellent results have been arrived at, so that the excavations originally proposed have been materially reduced.

THE CENTRAL LINE.

In an interview with Jeronimo Ossa, a member of the engineer corps in Panama, and who arrived in this city by the last steamer, it was ascertained that the surveying had been finished, and that attention is now concentrated upon determining the center of the canal. The route of the canal has already been cleared of trees, and with the above exception everything is in readiness for the excavation to commence. In fact, a contract has already been given to excavate a distance of eight miles, from Colon to Gatum, and it is expected that work will be commenced on November 1st. The machinery to be used in this work is in progress of construction, some of it awaiting shipment from this city to New York.

DAMMING THE CHAGRES.

The most important labor, that of erecting a dam at Gamboa on the Chagres River, engrosses the attention of the engineers. Over sixty kilometers of the river have been explored, and its affluents and currents studied, In another direction tracks have been laid for the purpose of carrying the excavated earth and stones to the proposed site of the dam, while along the whole route of the canal, from Colon to Panama, stations have been established. A large number of warehouses have also been built. A commodious hospital has been constructed upon an eminence in Panama for the benefit of the canal company's employés and placed under the direction of competent physicians. An additional contract to that cited above has been given for excavation of 87,000 cubic meters at Obispo, where a large warehouse will be built, as well as additional shops to those already erected. It is now definitely settled that the canal will be completed within the time originally assigned.

Passing from the recent developments, Senor Ossa stated that business in Panama, under the influence of the general activity along the line of the canal, had largely increased, and that the laboring classes experienced no lack of employment.—*San Francisco Chronicle.*

THE COAST SURVEY IN CALIFORNIA.

THE WORK TO BE PROSECUTED UNDER THE NEW APPROPRIATION.

The tardiness with which Congress passed the bill making the necessary appropriation for the continuance of the work of the United States Coast and Geodetic Survey, has delayed the field work considerably. Professor Davidson himself went to Washington to urge the bill's passage, and, having been successful, he has just returned. The amount of the appropriation for the Pacific coast is $170,000, this being $10,000 less than that of previous seasons. The Committee on Appropriations refused to report in favor of $100,000 additional, to be used in the construction of a vessel for the survey of the coast of Alaska, so that this important branch of the work has to be deferred another year.

Several important operations, however, have been carried on during the summer, despite the absent aid of an appropriation, under the direction of Superintendent Hilgard, such as the re-survey of the improvements of San Francisco Bay, by Assistant Langteller; the establishment of a permanent magnetic observatory at Los Angeles, by Assistant Lawson; the survey of dangerous channels in the Alexander Archipelago of Alaska, by Commander Nichols, and the topography and triangulation of the Columbia River, by Assistant Rockwell.

As far as can be learned the general assignment of field parties is as follows; Professor Davidson, with Assistants Dickens and Pratt, will occupy Mount Tamalpais and make the regular observations of the triangulation and latitude and azimuth. After that the party will occupy another mountain station and then Professor Davidson will leave for New Mexico to observe the transit of Venus. Assistants Rodgers and Forney are to continue the primary triangulation northward, their first station being King Peak in Humboldt County. Assistant Langteller will sail to-morrow with his party for the Umpqua River, in Oregon, where he will take up the coast triangulation and topography, working southward to connect with the survey of Coos Bay.

Assistant Rockwell is now at work on the survey of the Columbia River, doing both topography and triangulation. Assistant Gilbert is also at work at the triangulation and topography of Hood's Canal, in Washington Territory. Assistant Einbeck will continue the transcontinental triangulation. He will work in Southern Nevada and Utah this season. Assistant I. S. Lawson will go south and proceed to make primary triangulations from Point Concepcion northward. The Coast Survey steamer Hassler, under command of Captain Nichols, has been at work since April on the survey of the Alaska coast. The steamer McArthur is to continue the off-shore topography north of Point Arena, and the schooner Earnest will continue the hydrography of the Straits of Fuca. The permanent magnetic observatory of Los Angeles has been placed under the charge of Marcus Baker. The differential changes of the magnetic forms are recorded continuously by the aid of photography, and for three days of each month the absolute measures of magnetism are observed.—*San Francisco Chronicle.*

IMPROVING THE MISSISSIPPI.

THE QUESTIONS BROUGHT BEFORE THE COMMISSION NOW IN SESSION IN THIS CITY.

The Mississippi River Commission, which has charge of the expenditure of the money appropriated during the late session of Congress for the improvement of that river, has been in session this week. The President of the commission is Gen. Q. A. Gilmore, and the other members are Gen. C. B. Comstock, United States Army; Major Charles R. Suter, Unites States Army; Prof. Henry Mitchell, of the United States Coast Survey; Major B. M. Harrod, United States Army; Capt. James B. Eads, and Judge R. S. Taylor. All the members of the commission are in attendance except Capt. Eads, who is at present in Europe, and Judge Taylor, who is sick. The Secretary of the commission is Lieut. Smith Leach, United States Army, and the executive officer, who supervises the work, is Capt. C. B. Sears, United States Army. Work on the river is now going on at Plum Point, about 60 miles above Memphis, and at Lake Providence, about the same distance above Vicksburg. The work at Plum Point is in charge of Capt. J. G. D. Knight, and that at Lake Providence under Capt W. L. Marshall. The amount appropriated for the improvement of the river below Cairo is $4,125,000; from Cairo to the mouth of the Illinois River, $600,000, and from the latter point to the Des Moines Rapids, $200,000. There are also a number of unexpended balances, the principal of which are $110,000 for work at New Orleans, $89,000 for work at the mouth of Red River, $27,000 for work at Vicksburg, $7,000 for Natchez, and some smaller sums for other points, making in all over $5,156,000 which the commission will have to expend. The bill names New Orleans, Natchez, Vicksburg, and Memphis as points where improvements shall be made. The present meeting of the commission is called to consider what portion of the appropriation shall be allotted to the points mentioned in the bill, and also whether any portion of the appropriation shall be expended for levee repairs, and if so, what amounts and at what points. The commission will also consider several special questions which have been referred to it by the Secretary of War, but which are not yet in a shape for publication.

The commission effected its organization on Monday, and on Tuesday and yesterday listened to the views presented by the members of three delegations which are in attendance on the session. One of these delegations appears in the interests of the Louisiana levees, another for the Mississippi levees, and the third for the city of Vicksburg. Senator Lamar, of Mississippi, who is one of the delegates, spoke in favor of Mississippi's interests in general and Vicksburg's interests in particular. Judge Steele, formerly of New Orleans, but now of Natchez, Miss., spoke in behalf of the Louisiana levees, and endeavored to impress on the commission that the destructive floods to which the banks of the Mississippi are subjected are caused by the accumulation of waters in what are known as the Yazoo and Tensas bottoms, from the mouth of the Red River to the mouth of the Arkansas, and that it is within these points also that the greatest difficulties of navigation are to be found. He urged, therefore, that the levees along this portion of the river should be closed first. Col. Percy, of Mississippi, and Major Waddell, of Vicksburg, spoke to the same effect. The proposition of the Memphis & New Orleans Railroad and Levee Com-

pany to build between those cities a road which shall cross the mouth of the Yazoo Valley upon the top of a levee, the levee to be built out of the Government appropriation, but maintained by the railroad company, having been referred, after introduction into Congress, to the Secretary of War, and by him referred to the commission, C. P. Huntington, the president of the company, was heard in its favor. The hearing of these gentlemen occupied the commission up to noon yesterday, and during the afternoon various questions were discussed by the members. Among these were the establishment of a general supply depot at St. Louis, the amounts of the allotments for the various points where work is required, and various questions of administration. No definite action was taken, however, except that it was decided that a sufficient allotment should be made to the improvements at Plum Point and Lake Providence to enable the work to be carried on without interruption. The improvements at these points consist in the building of screens and sinking of mattresses with the object of narrowing the bed of the river, and thereby increasing the velocity of the current. It is probable, too, that work will be speedily begun at one or two other points.

MEXICAN NATIONAL.

Advices from the City of Mexico are that the State of Michoacan, by federal authority, has declared forfeited the subsidy granted to General Palmer for his narrow-gauge railroad, projected from Salamanca to Morelia, and that the State of Colima has also declared forfeited a State subsidy to the same road. Considerable grading along the line of the road has been done, but the work of construction will hardly be continued with the subsidy forfeited. The latest information regarding General Palmer's efforts to place the Mexican National loan abroad is that about $500,000 only has been subscribed, which renders the undertaking a practical failure.

The above paragraph from the *Evening Transcript* of July 29 is so crowded with misstatement and ignorant statement that it is, perhaps, worth while explaining the real facts of the case, for the protection of that portion of Boston which may read or trust the *Transcript*.

"The State of Michoacan, by federal authority, has declared forfeited the subsidy granted to Gen. Palmer for his narrow gauge road from Salamanca to Morelia." The State of Michoacan does not act by federal authority any more than does the State of Massachusett or New York. The subsidy granted Gen. Palmer for this line is a subsidy from the national government of Mexico, and the State of Michoacan can no more forfeit it than the State of Delaware can forfeit a national bank charter from the United States, State nullification of national legislation is not a part of the constitution of Mexico.

As to this Michoacan concession, the facts are these: The main line of the Mexican National Railway to the Pacific runs from the City of Mexico, through Toluca, Acambaro, Patzcuaro, etc., to the sea. That portion of the line from Acambaro to Patzcuaro runs through the State of Michoacan. The line for the whole route to the Pacific, however, was granted, subventioned and built under a concession from the federal government of Mexico, dated October 13, 1880.

Some time anterior to this date the federal government had given to the State of Michoacan a concession for a line running through its own borders and touching at Acambaro, Morelia, Patzcuaro, Salamanca and some other points. To provide against any possible claims or allegations of adverse rights, the Mexican National Construction Company took this old concession off the hands of the State of Michoacan by a transfer from that State to the company, dated December 13, 1880.

The actual line of the road-bed, as it now stands on the ground, from Acambaro via Morelia to Patzcuaro, has been, however, constructed carefully under the national concession and strictly according to its terms and conditions. This position has been established by law at each successive stage of construction. The surveys have been reported to the National Government, as demanded by the national concession, and formally accepted by the government. Regular inspections of progress of work have been made by a federal inspector from time to time, and the work accepted and approved by the government. Some months ago, on a technical point, the Governor of the State of Michoacan declared the forfeiture of the contract of transfer of the old concession. By the terms of the transfer itself, all that is forfeited by the State of Michoacan is the transfer. The company has appealed to the Supreme Court against this action of the Executive, and there the case rests. Even in case of an absolute forfeiture of this transfer of concession, it would only effect the company on the short branch line—about 40 miles—from Salvatierra to Salamanca. On this line no work has yet been done, consequently nothing is lost or imperiled except a right of way.

As to the Colima concession the facts are these: This subvention is a State grant of $1,500 per kilomètre, and is additional to the national subvention of $7,000 per kilomètre under the general concession. It covers only that portion of the main line running through the State of Colima—about 80 miles—and is payable in State scrip. Even if forfeited, it would not affect either the right of way or the national subvention on any part of the line. The company, however, has no advices of any such forfeiture. There could be in this sudden way no absolute forfeiture. The first step, under the concession itself, must be a declaration of forfeiture by the Governor of the State, against which the company has the right of appeal, if it chooses to exercise it.

As to General Palmer's negotiation in London, the misstatement here appears to be intentional and malicious, inasmuch as the *Transcript* itself, on the 19th or 20th of July, published a statement, furnished it at its own request by the Secretary of the company, presenting clearly the facts of the case, which are these: By a contract dated June 26, 1882, General Palmer negotiated with a strong European syndicate $10.000,000 of the first mortgage six per cent. bonds of the Mexican National Railway. This syndicate is represented in London by the old house of Matheson & Co., No. 3 Lombard street, whose head is Sir Alexander Matheson, M. P.; in Paris, by the Société Générale. The syndicate under this negotiation took $5,000,000 of these bonds firm, with an option of $5,000,000 more. How or when these bonds are put on the open market does not affect the company, which has already sold them to the syndicate. Whether the statement made by the *Transcript*, that the first public issue of them amounted to $500,000, or whether it was more or less, is not known to the company. It is not a transaction of theirs, and the syndicate has not communicated to them the information, as it is a business affair which pertains purely to the syndicate itself, and not to the company. The statement of the *Transcript* as to the amount taken, labors under the disadvantage of being made in a paragraph of which every other statement is false. —*Boston Journal.*

LUNAR INVESTIGATIONS.*

No papers on the moon published during the past year (1880) exceed in importance those by Mr. G. H. Darwen on the secular effects of tidal friction, on the configuration of a planet and its satellite. In the first paper the theory of a deformation of a viscous or imperfectly elastic spheroid under the attraction of satellites is investigated. Numerical calculations show that bodily tides in the earth are at present very small. From this point Mr. Darwen was led to consider the perturbed rotation of such a spheroid and the reaction on the perturbing bodies. He has, in the A. N. 2,294, given the following summary of the results arrived at through these investigations, which no doubt mark the beginning of a new era in our knowledge of the past history of the solar system.

1. The lunar period must have been shorter in the past, and may be traced back from the present 27.3 days, until, initially, the moon revolved round the earth in from two to four hours.

2. The inclination of the orbit to the "proper plane" must have been larger in the past and may be traced back from the present 5° 9′ until it was 6° or 7°. This was a max mum inclination, and in the more remote past the inclination was less, and initially, was very small, or zero.

3. The inclination of the proper plane to the elliptic must have been greater in the past and may be traced back from its present 8″ until it was in very early times about 11° 45′. It is possible that initially this inclination was less and that the 11° 45′ was a maximum value.

4. The eccentricity of the orbit must have been smaller in the past. Either at one time it had a minimum value, before which it had a maximum value, and again earlier, it was very small or zero, or else the maximum value never occurred, and the eccentricity has always been increasing. The history of the eccentricity depends on the nature of the tides of the earth, but the former of these alternatives seems the most probable.

At the present time the earth rotates in twenty-four hours, its equator is inclined at an angle of 9″ to a plane which Mr. Darwin calls "the proper plane of the earth" (the mean equator). This proper plane is inclined at an angle of 23° 28′ to the elliptic, and its intersection with the elliptic is the equinoctial line. He finds that the frictional tides in the earth have caused changes which may be summarizedas follows:

5. The day must have been shorter in the past, and it may be traced back from its present value of twenty-four hours until initially it was from two to four hours in length.

It was then identical with the moon's period of revolution as described in (1).

6. The inclination of the equator to the earth's proper plane must have been larger in the past, and may be traced back from the present value of 9″, until it was about 2° 45′. This was a maximum inclination, and in the more remote past the inclination was less, and initially it was very small, or zero.

7. The inclination of the earth's proper plane to the elliptic must have been smaller in the past, and may be traced back from its present value of 23° 28′ until initially it was 11° 45′, or perhaps somewhat less. It was then identical with the proper plane of the lunar orbit, and this is true whether or not 11° 45′ was a maximum inclination of the lunar proper plane to the elliptic as described in (1).

The preceding statements may be subject to varieties of detail, according to the nature of the tides raised in the earth, but the above is a summary of what appears to be the most probable course of evolution. The hypothesis which is suggested as most proba ble is, that the more recent changes in the system have been principally due to oceanic tidal friction, and that the more ancient changes were produced by bodily tidal friction. The initial state of the moon, nearly in contact with the earth, and always opposite the same face of it, suggests that the moon was produced by the rupture (in consequence of rapid rotation or other causes) of a primeval planet whose mass was made up of the present moon and earth. It is a remarkable coincidence that the shortest period of revolution of a fluid mass of the same mean density as the earth, which is consistent with an ellipsoidal form of equilibrium, is two hours and twenty-four minutes; and that if themoon were to revolve about the earth with this periodic time, the surfaces of the two bodies would be almost in contact with one another. The theory gives an interesting explanation of the rapid movement of the inner satellite of Mars.

* From the Smithsonian Report for 1880, page 212

GAS, WATER AND STEAM PIPES MADE OF STEEL.

The substitution of steel for iron grows more marked every day, says the *London Trade Exchange*. There are now several experiments making in the use of a much lighter steel tube for those of wrought or cass iron, and that with a decided advantage for steel for both pipe and fittings for water, gas or steam. In fact, as steel is the more compact metal, more uniform in character, and can be just as easily worked and a much less weight of metal used, its advantages are at once apparent.

Judging by the results of experiments in England and France, there is every possibility of the complete substitution of steel. Steel is far more durable, and as ⅛-in. steel pipe equals a ¾-in. of wrought, and $\frac{3}{16}$ to ½ in., the great economy which steel effects in labor and transit is at once apparent. The ordinary stock sizes of the tubes vary from 4 in. to 3 ft., in diameter, and they are in 12-ft. lengths. The unions are made by lap-folding and the sections are all tested by a heavier pressure than they will be subjected to in actual use. Mild steel varying from $\frac{5}{16}$ in. to $\frac{5}{16}$ in. in thickness is used in their construction.

A series of elaborate tests made in Paris on a set of steel tubes 3 ft. 3 in. in diameter and 5 millimeters thick proved that these mains had more resisting power than the ordinary mains manufactured either from wrought or cast iron. The vertical variation of the steel tubes 3 ft. 3 in. under a pressure of twenty tons continued for one hundred and thirty hours was only equal to 2.58 in. per cent., an amount that would be practically inappreciable in street traffic and heavy wear. The result of the test was deemed so satisfactory by the Paris authorities that a steel main was laid down from the Gas Works at St. Maude to the Place du Trone. For condensing or refrigerating purposes, again, light, thin steel tubes possess obvious advantages over cast or wrought iron.

Every description of joints, bends, spiggot ovals, flats and circular are made with equal facility, and the tubes can be either with or without flanged joints, or in any special form that may be required. The tubes are made and flanged by special hydraulic machinery, which insures perfect accuracy of the flangs and uniformity in the diameter in the pipes. The weight of a steel tube 24 in. diameter is 5 cwt. We have said enough to prove the great superiority of steel over either cast or wrought iron for mains of every description, while in the matter of cost and other incidental advantages in the way of freights and labor the steel is most advantageous in every way.

THE ESCUINTLA-GUATEMALA RAILROAD.

[From Special Report of Col. G. M. Totten.]

The proposed Escuintla-Guatemala Railroad will be an extension of the Guatemala Central Railroad. The latter road commences at the port of San Jose, on the Pacific ocean, and extends to Escuintla, a distance of 38½ miles towards the city of Guatemala, the capital of the Republic.

This railroad will extend from the terminus of the Central Railroad at Escuintla, to Guatemala city, giving this capital railroad communication

with the port of San Jose, the principal port of the Republic.

The location of this road was made by Mr. A. J. Scherzer, Civil Engineer, under whose direction and supervision the Guatemala Central road (lower line) was located and constructed. Mr. Scherzer has also estimated the quantity and quality of the excavation, embankment, masonry, bridging and other work that will be required in the construction of this road; all which I have examined, with the aid of the maps and profiles, and such inspection of the ground as time permitted, and have every confidence in their accuracy.

The length of the road as located by Mr. Scherzer is 88½ miles.

The gauge adopted is one meter, or 3.29 ft. (with privilege to change to 3 ft.)

The minimum radius of curvature will be 600 ft.

The grades will be steep—the elevation to be overcome being 3,896 ft. in a distance of 35½ miles.

The steepest grade will be 4¼ per cent., or 225 ft. per mile.

Escuintla lies at an elevation of 1,123 ft. above the sea. The summit point, 35½ miles distant, has an elevation of 5,019 ft., and the terminus at Guatemala City is at an elevation of 4,878 ft, so that there is a rise from Escuintla to the summit of 3,896 ft., and then a descent to the capital of 141 ft.

Adopting Mr. Scherzer's estimates of the quantities of excavation, embankment, masonry, etc., and such prices as the character of the work requires in that country, we obtain the following result:

197,992 cu. yds. of earth excavation; 318,832 cu. yds. of earth embankment; 16,800 cu. yds. of solid rock; 46,050 cu. yds. of loose rock; 2,707 cu. yds. of arch culverts' masonry; 2,579 cu. yds. of first-class masonry, 6,654 cu. yds. of second-class masonry; 4,366 cu. yds. of dry wall masonry; 1,100 square ft. of paving; 1,666 running ft. of pipe; iron viaducts and bridges and freight; 400 ft. of tunnel; grubbing and cleaning 38¼ miles; total cost of grading, masonry and bridging.....	$731,706.20
Cost of track, including freight and charges, ties, steel rails, 40 to 45 lbs. (ballast, ties, switches, sidings, etc.), ready for use.....	319,117.93

It only remains to estimate the cost of station buildings, shops, tools and fixtures, which will not be very extensive at the start. However, we will allow for them $150.000. We have then for the estimate:

Cost of the Railroad and Rolling Stock.

Grading, masonry and bridging.....	$731,706.20
Track.....	319,117.93
Station buildings and fixtures, freight depots, etc.....	100,000.00
Shops and tools.....	50,000.00
Fencing, telegraph and cattle gurads.....	25,000.00
Rolling stock.....	137,020 00
Contingencies—10 per cent.....	136,284.41
Cost of road and equipment (say $1,500,000).	$1,499,128.54

NOTES.

LIMITING DEPTH OF LIGHT.

THE limiting depth to which light penetrates in water was some time ago stated to be about 131 ft. for Lake Leman by Professor Forel, who used albumenized paper in his experiments. Mr. Asper has recently made similar experiments on the Lake of Zürich by a somewhat different method. He used the photographic plates called emulsion plates—more sensitive than albumenized paper—and immersed them during the night of August 3 to depths of 131, 164, 197, 230, 262 and 295 ft. They were brought up after remaining 24 hours in the water, and were treated with oxalate of iron. All the plates, without exception, were distinctly affected by the light. It will, therefore, be seen that the chemical rays penetrate in clear water to a depth of at least 295 ft.

RAILROADS SEVENTY YEARS AGO.—From the *Montreal Daily Star* we clip the following:

Mr. J. H. Dorwin has kindly furnished us with a copy of the following letter, written, in reply to a suggestion concerning railroads, by Chancellor Livingston, who had been associated with his brother-in-law, Robert Fulton, in the application of steam to navigation:

ALBANY, March 15, 1811.

DEAR SIR: I did not till yesterday receive yours of the 25th of February; where it has loitered on the road I am at a loss to say. I had before read of your very ingenious proposition as to the railway communications. I fear, however, on mature reflection, that they will be liable to serious objection, and ultimately more expensive than a canal. They must be double, so as to prevent the danger of two such heavy bodies meeting. The walls on which they are placed must be at least four feet below the surface, and three feet above, and must be clamped with iron, and even then would hardly sustain so heavy a weight as you propose moving at the rate of four miles an hour on wheels; as to wood, it would not last a week. They must be covered with iron, and that, too, very thick and strong. The means of stopping these heavy carriages, without a great shock, and of preventing them from running on each other—for there would be many running on the road at once—would be very difficult. In cases of accidental stops, or necessary stops to take wood and water, etc., many accidents would happen. The carriage of condensing water would be very troublesome. Upon the whole, I fear the expense would be much greater than that of canals, without being so convenient. R. R. LIVINGSTON.

SHARKS AND SUEZ CANAL.

An unforeseen consequence of cutting the Suez Canal has been the intrusion of sharks in large numbers into the Mediterranean Sea, with terrible resulting havoc among the smaller edible fish. Formerly a shark was almost a curiosity in the Mediterranean, and there was no choicer or better stocked fishing ground in the world. The fishermen of the Provençal coast supplied the cities of France with the best of piscatorial food, and in never-failing abundance; but they now have difficulty in furnishing half the quantity that they then obtained with ease.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

GALVESTON (TEXAS) WATER SUPPLY.—The Committee on Water Supply has submitted the following report: The Hon. Mayor and Board of Aldermen of the City of Galveston. Gentlemen: Your Committee on Water Supply, to whom was referred the several propositions to supply the city with water, beg leave to state that they, the members of said committee, like all others interested in the future of Galveston, can see, and not without considerable concern, the growing need of an ample, reliable and wholesome fresh water supply for domestic, fire, sanitary and other purposes, deeming the same next only to the problem of deep water, which we may now consider resolved into a question of time, and that but short. But the problem of a permanent fresh water supply, to come within the reach of all, and at the same time be pure and wholesome, is now of the first importance, and the question of supplying the same should be by us put into tangible shape as soon as possible; but in so doing it will be well for us to act on a terse old saying by "making haste slowly."

First and foremost of all is the question of a reliable and healthful source of supply. Second, whether it shall be supplied by a private corporation, or works owned by the city; and the third question is the matter of water rates, or cost to the city and private individuals. These questions can only be answered by a thoroughly practical hydraulic engineer. By making the necessary investigation, and formulating plans and specifications, upon which the city can have built, or a responsible company, taking the contract, can be required to build in accordance therewith; and from the estimated cost on these plans the water rate can be established. As to what these rates shall be, your committee, and no one not having considered the cost, can accurately state, and guessing is not a safe way to get at it. By way of comparison, one proposition before your committee offers to supply water for private use at 15 cents per 100 gallons. The city of Austin is so supplied at 5 cents per 100 gallons. The rate named for similar purposes in Council Bluffs is 35 cents per 1,000 gallons for the least supply, and 15 cents per 1,000 gallons for the greatest, while Peru, Ind., is supplied at the rate of 15 to 20 cents per 1,000 gallons. These figures are not given as a basis whereupon to establish a rate for Galveston, as our position in relation to the location of a supply is by no means similar to those of the cities named. Yet we hold that the rate named for us may be excessive, and would make the water-works and its commodity a luxury indeed.

We would, therefore, in view of the foregoing facts, suggest the propriety of employing a first-class engineer, such as is employed by other cities for like purposes, to make a thorough examination for an available source, and this fact ascertained, then to draw plans and specifications for the construction of a system such as we shall, in his judgment, require; and upon the estimated cost thereof, the rate can be established. Then the city to advertise for bids to construct said works in accordance with these plans. Either for the city's ownership or for a company to own same with the privilege of hydrant and other rates for a certain number of years as their remuneration.

Concerning a proposition to erect for and at the city's expense a system of salt water supply for fire purposes in certain district known as "the fire limits," your committee are in doubt as to the general good to arise therefrom. There is no doubt in the minds of the members of your committee that it would be of great benefit to those doing business and owning property in the district where these works would be operated, but would it be of equal benefit to the taxpayers at large, especially those who have no interest in the limits named, except it be that of cleaning brick and other like works by days' labor? To such it has the appearance of the greatest good to the smallest number. And as we have on inquiry learned that the service could not be made available for fresh water, it would in a few years become a dead loss to us. We therefore respectfully recommend that it be not adopted.

All of which is most respectfully submitted.

P. BARRY.
E. KETCHUM.
H. W. JAEGER.
Committee on Permanent Water Supply.

The report was adopted, and the committee was instructed to correspond with an engineer looking to an ascertainment of the cost of a survey for fresh water.

THE Department of Public Works of Chicago have submitted plans for three-feet water mains, compound duplex pumping engines, necessary foundations, and details to cost $250,000, for a high pressure supply for a portion of the south division of the city. An ordinance authorizing the construction of the works was also prepared, and the whole matter referred to the Finance Committee and Committee of Fire and Water of the City Council.

THE RICHMOND, VA., GAS WORKS.—The United Gas Company, of Philadelphia, have submitted a proposition to the Richmond board of aldermen to lease the gas works from the city for thirty years, at the rate of $50,000 a year. If the first proposition is accepted it is made a condition that the price of gas to private consumers will be reduced from $2 to $1.75 per 1,000 feet.

NAHANT, a rocky peninsula near Boston, where a few rich people go every summer in quest of pure sea air, had a severe outbreak of typhoid fever last year, there being about eighty cases. Nearly all, as investigation shows, were due to bad drinking water. These people, who gave so much attention to upholstering, sunk wells and let the water take care of itself. Out of 190 wells and cisterns examined, 111 were bad.

WORK has been begun on the foundations for a new high-service pumping engine for the St. Louis, Mo., water-works. It is expected that the engine will be completed about the end of 1882.

CATSKILL, N. Y., has voted to have water-works after the plans of John Lockwood, Hydraulic Engineer, 52 Broadway, N. Y. The Company is known as the Catskill Water Supply Co.

THE EXTENSION OF THE DISTRICT WATER-WORKS.—Major Lydecker, Engineer Commissioner of the District, will take charge of the extension of the water-works. Preparation for the work will begin immediately.

ARTESIAN WELLS.—DENVER, Col., Aug. 9.—Commissioner Horace Beech, who was appointed by the Agricultural Department at Washington to select the sites for two experimental borings for artesian wells in Colorado, made a trip to the prairie land in the eastern portion of the State to-day. He was accompanied by Senator Hall, the originator of the artesian well bill, and several railroad officials. The party went to the Platte (divide between the headwaters of the Republican River and the South Platte), 112 miles from the city, on the line of the Chicago, Burlington & Quincy Railroad. The geologist commission of last year reported this section of country as bearing the most promising indications of a high-water strata. One well will be sunk about a mile from Akron in a country heretofore dry and arid. Contracts will be immediately let for 2,500 ft.

It is thought that a strong flow will be tapped within 1,000 ft. The second well will probably be located near Kit Carson, on the Kansas Pacific road. The contracts on both wells will have been completed by snowfall. It will be remembered that the original $30,000 appropriation for artesian well explorations in Colorado was squandered under Le Duc's management. He started a well near Fort Lyon, and paid a heavy royalty to experiment in sinking with a diamond drill. When a depth of only 800 ft. had been reached by the bore the appropriation was exhausted. It was estimated that the same result could have been had under contract for $1,500. Senator Hill obtained the last appropriation from the agricultural fund, and is confident of discovering the flowing well belt. If successful, a vast expanse of country now barren and uninhabited will be converted into lands for agriculture and stock-raising.

ARTESIAN WELLS.—The experimental well being sunk at the Peoria water-works is now down to a depth of 750 ft. Sulphur water was struck at 715 ft. and is still flowing. They will continue to go down until they strike a vein of good water.

VICTORIAN WATER-WORKS.—A return has been issued of the various Victorian water-works on Dec. 31-1880, showing their positions, storage capacity, drainage area, length of aqueducts, mains and reticulations, and total or estimated cost. The works number 43, of a total storage capacity of 12,934,682,382 gallons, the cost being set down as £3,622,221.

ELECTRICITY.

THE ELECTRIC LIGHT has been adopted by the city council of Belleville, Ill.

RIVERS AND HARBORS.

THE IMPROVEMENTS ON THE POTOMAC RIVER.—Major Peter C. Hains, of the Corps of Engineers, has been ordered to assume charge of the improvement of the Potomac River in the vicinity of Washington, the establishment of the harbor lines and the raising of the river flats provided for in the act approved August 3, 1882, relieving Mr. S. T. Albert, civil engineer, who has charge of the work at present. Major Hains has the reputation of being an excellent officer. He was for some years stationed at Baltimore, and he has constructed some of the lighthouses in the most difficult localities on the Florida reefs and elsewhere. He is a son-in-law of Rear-Admiral T. A. Jenkins.

STREETS, DRAINAGE, ETC.

THE commissioners appointed to prepare a plan for disposal of the sewage of Saratoga Springs are still engaged in the consideration of the subject. The *Saratogian* states that they have substantially agreed upon a plan for collecting the solid deposit to be used for fertilization, letting purified water pass into Saratoga Lake. The details of scheme, however, are not yet fully matured.

THE Cincinnati Board of Public Works have awarded the contract for the construction of sewers in District No. 1, Division 3 (being nearly the whole of Ward 17), to Chas. M. Steele, at his bid of $70,389.25.

DRAINAGE OF MELBOURNE.—The City Council of Melbourne is endeavoring to improve the drainage of the Victorian metropolis. At the last meeting of the council, plans of a drain for carrying off the flood waters of North Carlton and the southwest portion of Brunswick, estimated to involve a cost of £10,856, and plans of underground drains for storm water in Elizabeth street, estimated to cost £44,880, were approved. It was

further resolved that these plans should be submitted for approval and concurrence to the Minister of Public Works as head of the sewerage department at Melbourne, with a request that he might assist the council by providing a moiety of the funds required for the works, and "credit the council's expenditure in this regard to the city in connection with any general scheme and appropriation for the sewering of the metropolis."

BOSTON SUED FOR DAMAGES.—W. C. Pollard and others, the contractors for doing work upon the Moon Island sewer, have brought suit against the city of Boston for an alleged breach of contract, and the damages claimed are $250,000. The plaintiffs claim that the city engineer's plans were drawn so negligently and carelessly that they could not perform the contract according to its terms. These allegations are denied by the defendant, who also files a general denial to plaintiffs' declaration. The suit has been brought in the Supreme Court.

RAILROADS.

NEW YORK, ONTARIO & WESTERN.—The right given to its stockholders to subscribe for $10,000,000 of the New York, West Shore & Buffalo Railroad held by it was generally availed of. The price was 50 per cent. of the par value, and places $5,000,000 in the treasury of the company. Responses were received from all, except a few remote or small shareholders, and almost the entire amount was taken. The terms were 25 per cent. of the amount down, and the remainder in monthly installments of 10 per cent., the last payment to be made not later than May, 1883. The bonds were issued by the West Shore Company to the New York, Ontario & Western in return for the surrender by the latter of its franchise between Weehawken & Middletown. The New York, Ontario & Western is also granted a lease, entitling it to use the line for 99 years. This part of the road, it is expected, will be finished and trains running by Jan. 1.

THE GENESSEE VALLEY TERMINAL RAILROAD COMPANY was incorporated on the 14th. The company is to continue 99 years. The road is to be constructed from or near a point in the center of the line of the Genesee Valley Canal Railroad, in the town of Chili, Monroe County, and thence by the most direct route, taking in the towns of Chili and Gates, to a point in the line of the New York Central & Hudson River Railroad about 800 feet west of the intersection of that road with the Buffalo Railroad in the town of Gates. The capital is $500 000.

RAILROAD ACCIDENTS.—Of those killed by railroad accidents in Great Britain last year, by causes beyond their own control, the proportion was one to 2,050,435. The proportion of the injured was one to 680,854. The totals were 108 passengers killed and 1,854 injured, and of employés 531 killed and 3,445 injured. From trespasses, suicides, and miscellaneous causes death came to 467 persons, and injuries to 965. The risk of travel is seen to be extremely low.

BUILDING APPROPRIATION.—The amount appropriated for public buildings in different parts of the country, is between $5,000,000 and $6,000,000. The various sums are fifty per cent. of what it is estimated will be required in each instance. So the contracts to be let, with the real estate, will amount to between $10,000,000 and $12,000,000.

TRACKLAYING is advancing well on the New York, Lake Erie & Western Coal & Railroad Company's line from Alton to Johnsonburg, Pa. The big bridge over the Kinzua is considerably more than half done, and they expect to have trains running in about sixty days. Contracts have been let for the construction of the Ridgway & Clearfield Railroad, 20 miles from Ridgway to Brockwayville. Barnes & McFadden are the chief contractors. They also hold the same relation to the New York, Lake Erie & Western Coal & Railway Company, mentioned above. These roads are situated in Elk and McKean counties, Pa., and a couple of weeks ago tracklayers were in demand. Nearly all classes of labor were scarce, as men were in demand in the bark-peelings and hay fields, at $2.00 per day.

STREET RAILWAY.—A stock company has been formed to construct another street railway in Jackson, Mich.

RAILROAD INCORPORATED IN ARKANSAS.—Articles have been filed by the Des Arc & Brinkley Railroad to run from Des Arc, Prairie County, to Brinkley, where the Paramore narrow-gauge road crosses the Memphis & Little Rock.

IMPROVEMENT OF THE SPRINGFIELD, EFFINGHAM & SOUTHEASTERN.—SULLIVAN, Ind.—The Springfield, Effingham & Southeastern has just completed arrangements to put its road in first-class condition, and to build a branch from here to Indianapolis for the purpose of developing the extensive coal-fields of this county. W. C. Lyon, General Manager, is now in Indianapolis completing the details, and we learn from P. H. Blue, Superintendent, that Charles Seymour, the Chief Engineer, is now here, and a full corps of engineers will be put in the field next week.

DENVER & RIO GRANDE EXTENSION.—The Utah extension of the Denver & Rio Grande Railway has been completed to Cimarron, 330 miles from Denver and 407 miles from Salt Lake City. As the company has now in operation about 108 miles of road extending eastward from Salt Lake City less than 300 miles remains to be built to complete the connection in this link. The grading is nearly finished, and the preparations made for rapid track-laying indicate that this new through line will be opened by Dec. 31.

NEW ILLINOIS ROAD.—Articles of association were filed for the New York & Council Bluffs Railway company, capital stock $425,000; incorporators, Isaac B. Hymer of Fort Wayne, and James B. Martin, Andrew Hancock, Frank H. Stive, William B. Whiffen, Gustavus A. Moatz and George Marsh, of Lacon. The principal office is at Lacon.

ROAD COMPLETED.—On the 11th inst. the last rail was laid that completed the Northern Pacific Railway between St. Paul and the crossing of the Yellowstone River opposite Billings. Inasmuch as the bridge is not finished trains cannot enter the town yet. The road will be pushed to the base of the Rocky Mountains by autumn, and trains will probably run over a temporary switch back into Boseman this winter.

THE KANSAS CITY & MEMPHIS.—The Kansas City & Memphis Railroad Company are pushing work on the line rapidly, and expect to finish to Memphis early in March. Mammoth Springs, Fulton County, is the point of the road's entrance in Arkansas, and Augusta Station, three miles north, will be the end of the first division. Three contractors are now at work on the line, and work is now progressing on every mile of the road. The total force of 1,000 laborers and 500 teams has been ordered doubled. The track will be of steel rails and the bridges of iron.

IRONED.—The Chicago, St. Paul, Minneapolis & Omaha line in Northern Wisconsin is now ironed to a point within 30 miles of Superior. The line will be opened during the next 90 days.

THE extensive works in connection with the terminus of the Grand Trunk Railway at Wiarton will be advertised in a few days. The amount to be expended is $50,000.

THE New York & Sea Beach Railroad is to be sold by the Sheriff to satisfy two mortgages, amounting to about $434,000.

THE Grand Trunk Railway Company has, it is said, entered into an agreement with Mr. Senecal and the North Shore Railway Company to build a branch line giving them uninterrupted connection between Quebec and Ottawa independent of the Canada Pacific Railway Company. They have also rescued the South Shore Railway and Tunnel charter and the Montreal & Sorel Railway, and will embark all their live freight for the British market at Sorel instead of at Port Levis.

THE CANADA PACIFIC RAILWAY.—Work on the Canada Pacific Railway construction has now reached 357 miles west of Winnipeg, and rails are being laid at the rate of three miles a day. The Thunder Bay section will not, it is officially announced, be opened for traffic this year.

THE N. P. R. R.—Tracklaying has been resumed on the Cassleton branch of the Northern Pacific Railroad in Dakota from Mayville to Larrimore. On the Little Falls and Dakota the track is laid to Sauk Centre, and it is expected the line will be completed to Morris—87 miles—by Oct. 1. Track on main line was laid into Billings, Mont., on the 11th inst.

DECLINING AN AWARD FOR DAMAGES.—MONTREAL, Aug. 15.—The arbitrators in the railway case between the local government and Duncan McDonald, the contractor, have awarded the latter $138,000 damages for the taking of the Occidental Railway contract from him. McDonald declines the award as being inadequate.

CONTRACTS LET.

A STREET CONTRACT LET.—A dispatch from La Salle, Ills., of late date, says: The Committee on the bottom road improvements met and awarded the contracts to the lowest bidders, as follows: B. F. Holland, of Utica, 38,093 cubic yards of grading, $7,999.53; Geo. Brown, of Peru, graveling 2,444¼ cubic yards, $1.955; rock work, L. Sanderson, $3,577.70, which, together with the $1,000 to be expended on the southern approach to the bridge, will make a total of $14,582.83. This roadway is over a mile in length, and crosses the Illinois River valley south of this city.

CONTRACTS LET FOR TELEGRAPH LINE.—Contracts have been let at Buffalo for the construction of a portion of the postal telegraph line between that city and Chicago, and work on the Indianapolis branch will commence August 21.

CONTRACT LET FOR IRON WORK.—Samuel J. Cresswell, of Philadelphia, has been awarded the contract for the cast iron work of the Lehigh Valley Railroad offices, at Mauch Chunk, and the large iron portions for the Swarthmore College, Delaware County, Pa.; also the stable fittings for the West Philadelphia and Lombard and South Street P. R. W. Co., Philadelphia.

A KANSAS RAILROAD CONTRACT LET.—C. G. Patterson, a Boston capitalist, has contracted to build the Topeka, Salina & Western Railroad westward from Topeka a distance of 180 miles. The line is practically an extension of the Leavenworth, Topeka & Southwestern Railroad.

STONE CONTRACT LET.—The contract for the stone work on the public buildings at Toledo, Ohio, has been awarded to the Collins Granite Company, of Bluehill.

DREDGING CONTRACTS AWARDED.—The New York State Engineer has awarded the following contracts: For dredging 10,000 cubic yards of earth and sand at Catskill Creek, to E. M. Payn, at 13.9 cents per cubic yards; for dredging the same amount at New Baltimore, to P. W. Myers, at 14 cents per cubic yard; for dredging 15,000 cubic yards at Troy, to E. M. Payn, at 30 cents per cubic yard.

HUNGARIAN CONTRACTS.—Contracts have been concluded by the Hungarian State railways for the purchase of 126,000 tons of rails, all of which will be supplied by native works.

It is announced that a competition of schemes for the construction of bridges over the Danube, to connect the Kustendje-Tchernavoda line with that of Bucharest-Fetettei will shortly be opened at Bucharest. Alternative projects for connecting these lines by means of a tunnel under the river will also be considered. Prizes amounting to 100,000 francs will be given for the best bridge plans, and 50,000 francs for those of the tunnel. The bridge works are estimated at about twenty millions of francs.

THE contracts for the grading of the Silver City, Deming & Pacific Railroad between Deming and Silver City were let last week. It is expected that the road will be in operation by the first of next spring.

THE following contracts were awarded at Kansas City on the 9th by the city engineer: Bluff st. bridge to the Wrought Iron Bridge Co., of Canton, O., at $9,885; work to begin at once and to be completed within ninety days. Constructing eighteen-inch sewers in sewer district No. 46, awarded to Wm. Faulkner at $1.89 per lineal foot, or $3,832.98 for the entire work. Curbing and guttering west side of May st., from Fifth to Sixth, awarded to P. Moore, at $1.10 per lineal foot.

THE contract for the granite work on the proposed monument at Monticello, Va., in honor of Thomas Jefferson, has been awarded to Dominic McMenamin, of Washington, for $8,500. The contract for the iron work of the fence, etc., has been awarded to the Manly & Cooper Manufacturing Company, of Philadelphia, for $3,440.

David V. Howell of New York City was awarded the contract for the construction of a life-saving station at Gale Beach, N. J., his bid $11,887, being the lowest.

There was a large attendance of contractors at the District Commissioners' office on Saturday, 12th, to witness the opening of bids for the extensive street work recently authorized by appropriations by Congress. The streets and avenues to be improved have been heretofore published in *The Republican*. The bids were opened by Lieutenant Greene, Auditor Vincent, and Chief Clerk J. C. Rock, and were as follows: Paving with asphalt block portions of Fifteenth west, Fourth east, Twenty-ninth west: bidders, William Hussey, $2.29 per yard; Patrick Maloney, $2.19; James Reynolds, $2.35, $2.35, $2.30; John Cudmore & Co., $2.43, $2.41, $2.39. Improving North Capitol street from E to K streets, Thomas Joyce, 19 cents for grading, etc.; James Reynolds, 17 cents; Bartholomew Readon, 15 cents; W. H. Maier, 21 cents; for improving F street, from One-half and Four-and-a-half southwest, P. Maloney, 18 cents; W. H. Mahler, 21 cents; Thomas Joyce, 18 cents; James Reynolds, 17 cents.

LAYING ASPHALT PAVEMENTS

on portions of New Jersey avenue, Massachusetts avenue, Rhode Island avenue, New Hampshire avenue, and Pennsylvania avenue, Fifth street east, M north, Twenty-sixth west, and Thirty-third west, all of which will be repaved with asphalt except between the car-tracks, where granite blocks will be used—H. L. Cranford, $2.26 for asphalt, 94 cents for granite blocks; A. L. Barber, asphalt, $2.25; granite blocks, 99 cents. Repairs to bituminous pavements—H. L. Cranford and A. L. Barber were the bidders, the former being the lowest. The committee reported as

THE RESULT OF THE SCHEDULING

the following: For paving with asphalt blocks, Peter Maloney's aggregate was $30,966.60, the others being respectively $32,380.60, by William Hussey; $38,081, J. E. Reynolds; $34,159.42, John Cudmore. For paving with asphalt, A. L. Barber was the lowest bidder for the work on New Jersey avenue, New Hampshire avenue, Pennsylvania avenue, Fourteenth street west, Second street east, D street southeast, Fifth street southeast, M street northwest, and Thirty-third street northwest, H. L. Cranford was the lowest for Massachusetts avenue and Rhode Island avenue. The committee will report on the other work to-day.—*National Republican*, 14th.

BRIDGES.

AN IMPORTANT BRIDGE AT LOWELL BURNT.—At three o'clock on the 5th, the Central Bridge in Lowell, across the Merrimac River, was destroyed by fire. It connected Centralville with the main part of the city, and as the nearest bridge now left is about 2 miles distant, great inconvenience will be experienced. The fire caught from a portable engine used by the Boott Cotton Mills in laying the foundation for a mill which they are extending into the stream. The first bridge at this point was built by a chartered toll company in 1825. The city secured and made it free in 1855, paying $26,000 as damages and costs. The structure was rebuilt in 1864 at a cost of $34,000. It was a wooden covered bridge, standing on two piers, besides end abutments. It had become inadequate for the public need, and a resolution passed the City Council last year to rebuild with iron at an early date. This disaster will expedite the work. Another iron bridge is in progress about half a mile up the stream, but cannot be utilized for several months. A cheap temporary pontoon bridge has been hastily constructed from the débris, which is used by pedestrians.

A special meeting of the City Council on the 5th, a resolution was passed to proceed at once with the building of a new iron bridge, to replace the Central Bridge, not to cost over $100,000. Its length is 585 feet. The city is now running a steam tug for free transportation of the public.

A LONG BRIDGE.—The Pensacola & Atlantic Railroad bridge, over Escambia Bay, Fla., two miles and a quarter long, is finished.

MAY BRIDGE THE ROCK RIVER.—An election will be held in Byron, Ill., on the 29th inst., to decide the question of the town borrowing $15,000, with which to construct a bridge across Rock River at that place.

A PENNSYLVANIA BRIDGE COMPANY INCORPORATED.—A charter was issued to the Bradford Bridge Company, of Pittsburgh, which proposes the erection of a bridge across the Youghiogheny at Bradford. Capital stock, $100,000.

MISCELLANEOUS.

THE Geo. D. Webb Granite Co. has purchased the entire granite works of Mr. R. L. Angier, of Fitzwilliam Depot, N. H., and has greatly enlarged its facilities for quarrying by introducing steam drills, steam derricks, etc., and is building new sheds to employ more stone cutters.

THE Court-house of Randolph County, Missouri, at Huntsville, has been burned to the ground. The building cost $83,000, and was insured for $10,000.

THE new pumping engines of the Loudon, Ont., water works were started on the 15th. They were manufactured by Killey, of Hamilton. The contract calls for 2,000,000 gallons per day.